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ABSTRACT

An evaluation is made of the technological, analytical, social, and political forces which operate on the public schools and influence their disposition toward the utilization of technology. Three chapters are devoted to delineating the manner and extent to which technology, accountability, and behaviorist learning theory interact. The potential significance of their combined impact is elaborated upon and illustrated by an idealized case in point in chapter IV. Chapter V deals with the expected opposition of unionized teachers and examines ways to build public preference for more effective, efficient educational technology through the dissemination of more accurate information. Chapter VI explores the social and political implications of introducing technology into education under the previously defined conditions and a summary offers some conclusions about technology, human freedom and decision-making. Two appendixes discuss: 1) vouchers, free schools and community control and 2) testing students and determining accountability.
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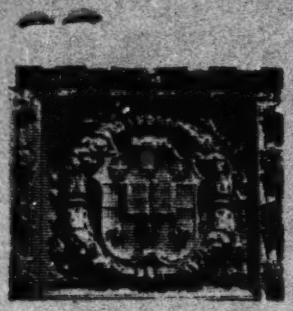

WASHINGTON UNIVERSITY

MEMORANDUM No. 73/6 DECEMBER, 1973

TECHNOLOGY IN THE PUBLIC SCHOOLS?

DALE LIPMAN

IR 000 208

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February 15, 1974

TO: Regular Receivers of Memoranda Released by Program on Application of Communications Satellites to Educational Development (NASA Grant NGR-26-008-054)

FROM: Robert P. Morgan
Principal Investigator

Enclosed you will find a copy of Memorandum No. 73/6, "Technology in the Public Schools?", by Dale Lipman. The work was performed by Ms. Lipman, a graduate research assistant, during the period from February 1972 to May 1973, under the supervision of Professor Barry Anderson, Graduate Institute of Education in connection with the "Needs Analysis" phase of the above-mentioned NASA-supported program. It is hoped that it will prove useful to organizations and individuals concerned with educational technology and telecommunications.

Any comments, criticisms or suggestions you may have would be appreciated.

RPM:esp
Enclosure

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CENTER FOR DEVELOPMENT TECHNOLOGY
(Communications Group)

WASHINGTON UNIVERSITY

Memorandum No. 73/6 December, 1973

TECHNOLOGY IN THE PUBLIC SCHOOLS?

DALE LIPMAN

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It is the purpose of this paper to attempt an evaluation of the forces operating on the public schools which might influence their disposition toward the utilization of technology.

TECHNOLOGY IN THE PUBLIC SCHOOLS?

INTRODUCTION

Public education is in trouble. In the face of the ever-rising costs of operating our schools and demands of teachers' unions for higher salaries and increased benefits, school districts across the country are confronted with something of a taxpayers' revolt. The taxpayer himself daily contends with rising prices and increased taxes over which he seems to have no control. It is not surprising that public scrutiny should focus on the schools, for school bond issues and tax elections are among the few opportunities for the taxpayer to have some personal influence over who gets his tax dollar and how much. And it is not surprising that he says "No!" when he takes a closer look at what he's getting for his money.

Students are coming out of schools ill-equipped to join the labor force; businessmen complain that graduates are functionally illiterate. Inner-city and rural kids fall further and further behind on achievement tests and/or drop out; suburban kids cry for relevancy and are increasingly dropping out.

It has been suggested that in the wide-ranging technology and know-how generated by our multi-billion dollar investment in research and development in such government agencies as the National Aeronautics and Space Administration, the Department of Defense, and the Atomic Energy Commission lies a fund of knowledge that can be adapted and applied to the solution of such public problems as those found in education. It is proposed that large-scale utilization of available technology and skills would produce better results more efficiently.

It is the thesis of this paper that the answers to such questions as whether, when and how technology is utilized in a society are contingent upon the social and political conditions prevalent in that society. It is further suggested that three major developments in our society have great bearing on how these questions will be answered with respect to education: 1) the very fact of the development of impressive technologies in the DoD, NASA, and AEC, and their interest in finding and encouraging civilian application of their discoveries; 2) the current predicament of local school districts, pressured by calls from the public and from state and federal authorities for pedagogical and fiscal "accountability"--encouraging the receptivity of educators to the idea of utilizing available technology and skills to provide better education more efficiently; 3) a behaviorist learning theory which supports, even demands, the systematic use of technology to improve education. The convergence of these three developments in our society today constitutes a powerful force conducive to the large-scale utilization of technology in education.

Chapters I, II, and III are devoted to delineating the manner and extent to which these three factors are manifested and interrelated, and the potential significance of their combined impact, that potential being illustrated and elaborated upon in Chapter IV via an ideal type case in point.

Chapter I notes a growing public awareness of and appreciation for the development of impressive technologies in the DoD, NASA, and AEC through the use of systems analysis, complemented by a concomitant and/or consequent interest on the part of officials within these agencies and potential beneficiaries (including educators) to adapt and apply these technologies for civilian usage, e.g. Air Force developed programmed

instruction and simulation techniques, NASA interest in potential educational uses of computer technology and communications satellites.

Special emphasis is placed on the "technology" of systems analysis itself, a highly sophisticated problem solving technique used as an aid to decisionmakers by quantifying the consequences of alternative courses of action. For we find that systems analysis is being put forth as a model for the solution of social problems (e.g. education), particularly in the form adopted by the DoD, the Planning-Programming-Budgeting System (PPBS). Systems analysis in this form involves defining program objectives and sub-objectives in operational terms and grouping resource requirements and activities by objective. Such a technique facilitates the analysis of alternative strategies in terms of their relative effectiveness in meeting specified objectives and in terms of their costs, both current and projected into the future. We observe that the Rand Corporation, once primarily concerned with doing systems analysis for the Air Force, is now engaged in applying forms of systems analysis, including PPBS, to the solution of civilian problems, including those in public education. Moreover, we are cognizant of a suggestion to use monetary incentives to encourage the use of systems analysis.

In view of the original success of the quantitative methodology of systems analysis in improving man-machine systems, I suggest that educators influenced by the model of systems analysis will be disposed to consider the use of developing technologies and to think of the education enterprise in terms of man-machine systems.

The survey of the accountability movement in Chapter II reveals that the bulk of this rather broadly based movement involves attempts to improve

the functioning of school bureaucracies* and that it tends to dovetail with the influence of systems analysis and PPBS--insofar as virtually every aspect of the accountability movement addresses the issues of costs and/or effectiveness. Implicit, and often explicit, in the call for accountability is an appeal to "systems" thinking. Discountented tax-payers, parents, students, legislators, and other critics and educators are demanding that material and human resources (input) be related to and determined by desired results (output). A corollary to this notion is the demand that every contributor to the school experience be held accountable for the effectiveness of his contribution. And implicit in this notion is the use of incentives. Effective contributions merit reward. Others do not.

While the accountability movement is still in an embryonic stage, the influence of systems analysis and PPBS is apparent in the efforts of educators to be responsive to criticism and demands. Beyond the (usual) initial decision to individualize instruction for increased effectiveness, programs vary in their emphasis on one or more aspects of the process, ranging from rudimentary structuring of resources and activities around operationalized objectives to sophisticated techniques of cost-effectiveness analysis and assessment of accountability, stressing pedagogical and/or fiscal accountability. We do note that the validity of many of the applications of quantitative methodologies to education is under contention, both in the measurement of student performance (output) and in the relative contribution of resources (input).**

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* Three peripheral "movements" are discussed in Appendix A.

** Some of the issues involved in the question of valid assessment are discussed in Appendix B.

Nonetheless, efforts proceed to improve measuring instruments and methodologies; and while they do, major school districts are taking steps to implement PPBS and many state legislatures are either mandating or considering its use in the public schools.

In our sampling of programs of individualized instruction, we do find educators utilizing educational technologies, conventional media and computer applications. The latter is used in computer-assisted instruction (CAI), primarily for the presentation of programmed instruction, and computer-managed instruction (CMI) which facilitates record keeping and program structuring but can also bring to bear a wider array of data available on students than would normally be utilized systematically. Ultimately, the contribution of educational technologies will be subjected to cost-effectiveness analyses which may well determine the extent of their future application.

Chapter III points out that the influence of systems analysis and the utilization of incentives and technology in the accountability movement are buttressed by a behaviorist learning theory, itself a form of systems analysis and the foundation of programmed instruction. Emphasized is the fact that B. F. Skinner, the recognized "father" of programmed instruction, believes that anything can be taught, if we define the terminal behavior (desired results) in operationalized terms and base the structure of contingencies of reinforcement (positive incentives) on careful analysis of that behavior, but that the efficient arrangement of such contingencies is a sufficiently complex and demanding task to virtually require the utilization of technology. We perceive that the notion of programming instruction by breaking down a task into small units and rewarding appropriate behavior is a powerful and growing force in education, particularly among those utilizing educational technology.

Chapter IV examines an ideal type case in point, OEO's one-year "test" of performance contracting, illustrating the convergence of those forces operating on the public schools (discussed in the preceding chapters) that might be conducive to their use of technology, and offering a glimpse of the potential significance of such a convergence.

OEO's "test" was designed to evaluate the relative cost-effectiveness of existing techniques of teaching offered by educational technology firms; firms were held accountable for meeting established objectives; incentives were utilized at every level; all firms utilized programmed instruction.

Analyses of effectiveness* discern no significant difference between experimental and control groups, with some few exceptions. Unfortunately, there is no indication of what makes those exceptional cases significantly different from their control groups, i.e. the relationship between resources expended (input) and student performance (output). The more sophisticated techniques of economic analysis reveal that some experimental programs cost less than their conventional counterparts and that some of these were less time-consuming--of no small import, especially to low-achieving, slow learning students, the prime target of accountability, in general, and performance contracting, in particular. Of primary importance to this study is the fact that those programs which were most economical proved to be those which spent less on certified teachers and more on paraprofessionals, materials, and equipment.

We call attention to the results of Rand Corporation researchers in other areas which "imply that the development of techniques for instructional system design can radically improve the effectiveness of instruction

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* keeping in mind the difficulties of measurement in education and its embryonic stage of development.

in almost any context" (emphasis added) and find that

> Rand is developing a computer program to examine the use of communications media systems in instruction. . . .This program will develop ways of integrating media systems with other elements of instruction based on the criteria of cost, practicability, and conformity with instructional strategy. (Pincus, 1971:11-12)

And we suggest that future cost-effectiveness analyses of educational technologies may be highly attractive to school district personnel, faced with demands for fiscal and pedagogical acccuntability, and instituting PPBS or in states that are doing so.

Chapter V deals with the expected opposition of unionized certified teachers to the implications of cost-effectiveness measures and incentives, and particularly to the use of technologies which may ultimately cost them their jobs. It considers their current public support, based on distorted facts, and concludes that, given the public preference for better management and cost-cutting, the dissemination of more accurate information may undercut that support. Such cost-efficiency and cost-effectiveness information are expected from the newly established National Institute of Education, whose mission includes research and development designed to increase our ability to use technology and media effectiveness in education. Knowledge generated by the NIE (or elsewhere, e.g. Rand) could feed into PPB systems being established in school districts and states--and gather support from the fact that local districts are dependent upon states for a sizable portion of their income, states (perhaps, supported by federal agencies) which may offer incentives for the utilization of the results of their research.

We do recognize the distinction between conventional audio-visual materials and large-scale systems of instructional television or computer-assisted instruction, focusing on the dearth of software available for the

latter. We conclude with the possibility that--based on the future forecasting of PPBS analyses--given the economic pinch school districts are in, they may well engage in some form of joint or centralized decision-making to create a sizeable enough market to encourage the production of software. And we may well see such large-scale systems.

Chapter VI is an attempt to explore the social and political implications of the large-scale introduction of technology into education under the conditions delineated in preceding chapters. For we noted in Chapter I the dependence of systems analysis on quantitative methods and its relatively greater success in improving man-machine interactions. And we suggested then that those applying systems analysis to education might well be influenced to conceive of the education enterprise in terms of man-machine systems. We must here take heed that we do not become so fascinated with the machine that we lose sight of the nature of man.

Emphasis is placed on the particular importance of this point, given the behaviorist learning theory (itself a form of systems analysis) undergirding so much of the movement toward the utilization of technology in education and the foundation of the programmed instruction for which that technology will be used. For however much advocates of programmed instruction assert that their students are actively involved in the learning process, that "activity" is always in response to stimuli carefully structured to shape their behavior. They are engaged in a thoroughly passive activity, because behaviorist learning theory views man as a thoroughly passive creature totally shaped by his environment. He is completely malleable--putty, if you will, in the hands of his controlling environment and he who shapes those controls.

Other theories see an inherently active, creative side to man--a vital need for freedom, bound to resist all forms of control--recognizing repression

in control. We are, of course, talking about values--but not merely values. For if Mead and Freud and Marx represent a more valid notion of the nature of man, we are talking about repressing a vital need.

The possibility of repressing a human need for freedom through the large-scale use of a more effective educational technology demands that we ask questions about the nature of the decisionmaking about what will be taught and who will be teaching it (who will be writing programs toward what end). For contrary to the assertions of people like Skinner and the creators of a surveillance and detection system of CMI, we cannot make decisions in the interest of our culture. Our culture is made up of people who have different interests.

The dangers of overlooking the diversity of interest in our society is exemplified by the quantitative methods which are the essence of systems analysis and PPBS--which define a system operating in an environment, the limits of which are beyond control--and responsibility. When systems analysts attach numbers to sociological factors and the computer spews out the alternatives, we cannot forget the political implications of the power of those analysts over the fate of real people. We cannot be blinded by the mystique of the machine, be it CAI, CMI, or large-scale social analysis.

People make decisions and we must assure that access to decisionmaking remain wide open--and that no large-scale system be mandated.

I. HAVE TECHNOLOGY--WILL APPLY

> Can the "systems approach," which has helped build America's missile and space power, be put to work effectively in the rejuvenation of American public education, so sorely in need of curriculum reform, new and imaginative plants and equipment, and daring redefination of its purposes in an era of satellites and civic strife, computerization of the workaday world, and the well publicized revolution of rising expectations in the poverty-stricken "other America"?
>
> The answer to this overwhelmingly important question is not yet available because the question has only recently begun to be asked. Among the most persistent questioners is the Aerospace Education Foundation, an affiliate organization of the Air Force Association. In 1966, the Foundation adopted as a priority goal the exploration of the potential of the new educational technology--much of it developed by the Air Force through the use of the systems approach--for the enhancement of America's civilian schools.
>
> Toward this end, the Foundation, on a year-round basis, has been working with the U. S. Office of Education and with local and state school officials around the country on a number of projects designed to extract ideas and adaptations for civilian use from the Air Force's store of new and proven space-age instructional techniques and systems. These range from learner-paced programmed teaching to use of multi-media courses that use simulation techniques which can subject the student to real-life environments in which the consequences of the student's decisions and the depth of his understanding of the subject matter are immediately clear to the learner. (Leavitt, 1968:ix)

William Leavitt's expression of support and enthusiasm for adapting technology developed by the Air Force for use in civilian schools were made in the Preface to Technology and Innovation in Education, a volume prepared by the Aerospace Education Foundation, based on an annual seminar held in cooperation with U. S. Office of Education. The seminar was devoted to "the call to action in the job of putting already available educational technology to work in America's schools." It was characterized by Dr. R. Louis Bright, then U. S. Associate Commissioner of Education for Research, as having "more intellectual power than has ever before been mobilized for an exercise of this kind." (Leavitt, 1968:x)

Such statements and the very existence of this volume, and others like it, are indicative of a growing commitment to channel space/military/

nuclear technology into the civilian sectors of our society where it can be used to solve the problems of private industry and applied to the public problems of government agencies, thereby broadening the benefits of an otherwise restricted research and development effort.

Richard Lesher's study of effective means for channeling these new technologies in promising directions emphasizes that "a wide range of kinds of technology will be transferred, including inventions, discoveries, developments, modifications, systems and techniques" (Lesher, 1966:66). In his discussion of how technologies with potential civilian application might be identified, Lesher (1966:155) notes that NASA provides a model in the NASA Office of Technology Utilization.

> The Space Act of 1958 charged NASA with the obligation to "provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof."
> In response, NASA has evolved a program, under an Assistant Administrator for Technology Utilization, to identify new technology resulting from the agency's broad ranging R&D programs, to report it (where practical) in industrial terminology, and to communicate it to organizations in the civilian economy through several mechanisms, including regional dissemination centers. (Lesher, 1966:117)

Of course, much of this technology will be of little use to local public school districts, but even the most obvious--the use of satellites to deliver education--implies the possibility of large-scale use of technology. The feasibility of utilizing satellites for this purpose is at least partially dependent upon wide-spread use of such technologies as instructional television and computer-assisted instruction.

Systems Analysis

Beyond application of any particular type of technology, Lesher notes Sumner Myers' attention to a more fundamental kind of transfer.

> He sees such activities as the space program setting new standards of achievement for the entire technical community. He asserts that "the space program may be stimulating the process of technological innovation by changing professional norms and general attitudes." He suggests that "the very existence of the space program as a model of technological achievement may prove more important to the economy than either the multiplier effect of its investment or the spillover of its technology."
>
> Noting that "the chief factor making for innovation in a community is prior innovation," Myers contends: "Perhaps the most pervasive contribution of the civilian space program may turn out to be the strength it has given, at the firm level, to those who push for innovation. The people who are for innovation now have more significance and have stronger arguments than those who oppose innovation. This is not only true at the firm level but is also encouraging people to push for bolder social undertakings Whether they approve of the particular goal of the space effort or not, they use it as a model of how things might be done--from curing cancer to rebuilding cities. (Lesher, 1966:67)

The use of the space effort "as a model of how things might be done" involves the utilization of the problem solving capability developed in the military/space sphere, methods for which Lesher finds insufficient encouragement in the civilian sectors of our society.

> But, David Allison and others have suggested: "The most important derivation of this (the military/space) R&D effort is likely to be a new ability to solve problems. Not strictly technical problems, but those involving a mix of components: Technical, managerial, psychological, social, political." (Lesher, 1966:69)

This problem solving capability is a highly sophisticated systems analysis approach which, though used earlier, came into its own during World War II when scientists became involved in developing methods for putting weapons (e.g. radar) systems into operation. L. Eugene Root discusses a definition of operations analysis that emerged from the military experience:

> "Operations analysis provides quantitative bases for management decision." Four things should be noticed about this definition. First the analyst, by implication, is not the manager and does not himself make the decision, at least in his role as analyst. Second, the information supplied to the manager is quantitative. It attempts to indicate in some numerical form the consequences of various possible decisions and thus to clarify for the manager the consequences of his action . . .

> In the third place, there is the old dilemma that quantitative recommendations are no better than the input data on which they are based.
>
> The fourth point relating to our definition postulates the existence of someone who can take all the relevant inputs and make a decision. (Root, 1970:4-5)

Root notes that systems analysis

> in the very nature of its dependence on quantitative methods has been most successful in fields which have a large technical content and a rather smaller emotional or psychological content. Operations analysis in wartime dealt with improving man-machine interactions--finding out the best way to use new and complex devices. (Root, 1970:6)

Nonetheless, he urges us to attempt the application of systems analysis in the quest for solutions to social problems. I would submit that schoolmen, pressed for solutions to their own growing problems and turning to systems analysis for assistance, may well be influenced to consider among their alternatives the use of developing educational technologies and to conceive of the education enterprise as something of a man-machine system.

Root's comments introduce The Challenge to Systems Analysis: Public Policy and Social Change, a collection of papers suggesting the application of the systems approach to such problems as urban development, communications, population control, the world food problem--and computer-assisted instruction. The paper by J. A. Stockfisch on the introduction of systems analysis into the Department of Defense is suggested as "a 'case in point' that has general relevance wherever man seeks to use instruments of the state to achieve objectives" (Stockfisch, 1970:8). It is proposed as a model to help executives manage bureaucracies efficiently, and Stockfisch specifically mentions local school boards among the possible beneficiaries of these methods. As schoolmen are, in fact, turning to systems analysis for aid in coping with their problems and since proposals for action are increasingly made in terms of the systems approach, we

we would do well to examine the model rather carefully.

Stockfisch begins his discussion with a review of the problems involved in managing a bureaucracy, emphasizing the distinction between the role of the "executive" and that of the "operator." The executive is the policy maker, the specialist in ends; the operators are the doers, the specialists in means who make up the line agency, the bureaucracy. The desire of the line agency to maintain its autonomy leads it to engage in a variety of activities to elude the direction of the executive, not the least of which are its efforts to keep him in ignorance of its activities. Any effort on the part of the executive to interfere with the activities of the line agency, to "rock the boat," to change policy, is met with resistance and hostility.

Stockfisch summarizes:

> 1. There is a lack of useful operating knowledge at the executive level. . . .
> 2. As a results of condition 1, the executive office is unable to determine whether in fact its policy goals are being implemented.
> 3. Because it cannot clearly determine whether its goals are being implemented, the executive has no objective check of whether his stated goals may be mutually consistent or whether they are even feasible. Without knowledge of whether they are feasible, it is hard to know what their cost of attainment will be. Thus not only may the executive office be in the dark, but also the administration as a whole may wind up kidding itself . . . . Finally, there is no measure or way of knowing, even in the case when a policy goal is being achieved, that the goal is achieved in the most efficient or least costly manner.
>
> (Stockfisch, 1970:16-17)

In order to cope with the problem of gaining knowledge about the operations of the Department of Defense upon which to formulate consistent, feasible policy goals and to determine whether they were achieved efficiently, Secretary of Defense McNamara and his staff instituted two innovations. The first has come to be called the planning-programming-budgeting system (PPBS). The second created a systems analysis staff.

Defense policy goals involve systems and units which cut across service line agencies--"for example, combinations of strategic bombers and Polaris submarines or of Army divisions, tactical Air Force squadrons, and Naval carrier strike forces. Organizations and units are drawn from all three services and placed under a single and unified command." (Stockfisch, 1970:17) The traditional practice of each service submitting separate budgets itemizing its separate needs for research and development, personnel, procurement, operation and maintenance, and installations was incompatible with the decision makers' need to know the cost of a given system or program. By devising a budgeting system that begins with identifying policy objectives in terms of the programs or "mission responsibilities" cutting across service lines and then determining costs on the basis of input, from whatever source, the policy maker is in a position to know the cost of any given program (and its elements) designed to perform a specified function. Moreover, by using this budgeting system, it is possible to project the costs of a program and its elements over a period of years, thus making it possible to see the implications of current decisions for the future.

Stockfisch emphasizes the advantages of being able to identify systems designed to perform specified functions. For given the defined ends, or policy objectives, a systems analysis staff is employed to utilize operations research to analyze alternative mixes of elements or inputs of the system and to utilize economics to specify and quantify effectiveness criteria. Thus, means can be related to ends in such a way as to aid policy makers to make rational decisions in terms of effectiveness and efficiency. Cost-effectiveness studies have become the basis upon which new programs or program changes are justified. (Stockfisch, 1970:17-19)

Systems analysis was the primary concern of the Rand Corporation in its work for the Air Force. Rand analysts are now applying their methods to aid in the solution of civilian problems, e.g. law enforcement, public health--and education. At the 26th Joint Study Group on Military Research Allocation Methodology, David Levine presented a paper on Structuring Program Analysis for Education Research (Levine, 1970) and Polly Carpenter presented A New Kit of Tools for Designing Instructional Systems (Carpenter, 1970). In fact, as we shall see, Rand analysts have done a considerable amount of research and evaluation of the problems of education. Many of their analyses and proposals for solutions are summarized in Policy Studies at Rand: Education and Human Resources (Pincus, 1971).

Lesher has suggested that the most pervasive "technology" to come out of the military/space sphere is systems analysis. Should application of such an approach to managing our school bureaucracies demonstrate the effectiveness and/or efficiency of educational technologies, relative to alternatives, its influence could indeed be pervasive among educators pressed to find solutions to their problems.

Incentives

Pursuant to the notion of systems analysis is a suggestion proposed at an Engineering Foundation Research Conference on "Technology and its Social Consequences."

> The suggestion involves local competitions for government grants to design systems solutions to urban problems. Patterned in part after the Atomic Energy Commission's requests for proposals on the location of its proposed new linear accelerator, the suggestion would be for the Federal Government to offer a sizable grant--or matching funds--to the winner or winners of a competition for the design of systems for mass transportation, waste disposal, and other urban problems. (Lesher, 1966:143)

As we shall see, pressed by demands for more effectiveness and efficiency

--accountability, educators are receptive to the use of systems analysis, competition for funds (the use of incentives), and technology as possible solutions to their problems.

II. ACCOUNTABILITY--DO IT!

There is a rather pervasive "accountability movement" in education today whose aims are strikingly similar to those Mr. McNamara had in mind when he instituted systems analysis and PPBS in the Department of Defense. The movement is permeated with the notion that schoolmen are "accountable" for actually doing what they are supposed to be doing--educating our youth--and doing it effectively and efficiently. And so, people are engaged, in a variety of ways, in attempts to evaluate what the schools are doing and to formulate alternative approaches to operating the schools to achieve policy objectives.

What Is It?

The notion of accountability in education is not a new one. It has doubtless been around as long as teachers. In ancient Greece, except for the Sophists who taught for a fee, most education in the polis took place informally in public discourse--at the marketplace, in the gymnasium, in public assembly. When a man like Socrates gained a reputation for his wisdom, he attracted a circle of followers; and thus, in part, were the youth instructed. However informal the discourse, such a man was accountable to the polis. And, indeed, when Socrates' unconventional teachings and criticism of Athenian democracy were adjudged to be sacrilegious and ard corrupting the young, he was sentenced to death. Since then, of course, our concept of education has become increasingly formalized and our notion of accountability increasingly precise and specific (though, to be sure, the punishment less severe). Roger Lennon reminds us:

> At the University of Bologna in the 15th century, student-enacted statutes required that the "professor start his lectures at the beginning of the book, cover each section sequentially, and complete the book by the end of the term"; should any professor fail to achieve the schedule, he forfeited part of funds that he himself had had to deposit at the beginning of the term.

And then:

> The concern of governmental bodies that they were getting their educational dollar's worth is hardly new. In 1911 the Board of Estimate of the City of New York, critical of the demands made by the Board of Education on the city's treasury, launched a survey of the city's schools, one aspect of which was an analysis of the tested arithmetic achievement of its pupils. (Lennon, 1971:4)

Callahan (1962) has studied the "cult of efficiency" which grew out of Frederick W. Taylor's time and motion studies in the nation's steel mills. During the 1910's and 1920's, education "engineers" and "experts" appeared on the scene urging the adoption of Taylor's "scientific management" and attempting to apply his methods and use of development capital, outside audits, analysis of process, establishment of standards, incentive pay--all designed to relate factory input to output most efficiently. Unfortunately, a good deal got lost in translation. They failed. We are left with a legacy of red tape, mountains of record keeping, rigid standards, and barely a trace of relating input to output. Callahan suggests that they were more interested in economy than efficiency and that they had neither the research skills nor the money necessary to be successful at such an undertaking.

Today's accountability movement, partly inspired by the success of systems analysis and the use of incentives in our military and space efforts, echoes many of Taylor's concepts. We may well have the necessary research skills; we certainly have considerably more research money than available fifty years ago.

But accountability today means many things to many people encompassing a broad range of interests and issues. It is generally a striving for ways

and means of affixing, assuming and meeting responsibility for the education of our youth. And it is rooted in a pervasive and often intense discontent with the functioning, or malfunctioning, of our schools today.

Primarily from our suburban students, we hear cries for "relevance" in protest against rigid standards reflected in sterile, inflexible curricula and the monotony of the trivia directed at them daily. They complain that they can find no relationship between what goes on in their classrooms and what they see and hear and know about the real world around them. They are demanding a clear relationship between what they spend so many hours of the day on, so much of their lives, and what is truly important to them.

A bit of the "relevancy" theme can be found in the inner city, where minority groups are demanding that greater recognition be given to their unique characteristics and their contributions to our society. But "relevance" can be icing on a cake they do not have. Their problems are grave. Burt and Lessinger (1970) quote former U.S. Commissioner of Education, James E. Allen:

> One of every four students has a significant reading deficiency.
> In large city school systems up to half the students read below expectation.
> Half the jobless youth, in the 16-21 year old age bracket, is functionally illiterate--this illiteracy represents a barrier to success and produces lives marked by poverty, unemployment, alienation, and in many cases, crime. (Burt and Lessinger, 1970:144)

It is here that the accountability movement picks up steam. The fact that so many of our youth are not receiving even the most basic education provokes first dismay and then indignation, not only among the minority poor, but in society at large. And it is here that demands for educational accountability become linked to demands for economic accountability, that links are made between costs and effectiveness. State legislators, pressed by the increasing costs of education and requests for funds, and congressmen used to thinking in terms of "more bang for the buck" are asking questions that schoolmen are having difficulty answering: Where is all this money

going? For what? They are demanding not just lists of materials and services purchased but an accounting that relates resources expended to program objectives--output. Likewise taxpayers are regularly refusing the requests of school boards for the passage of bond issues and increased taxes.

The sticky question then becomes: Who is accountable to whom and for what? Alkin (1972) has suggested that three basic types of accountability can be discerned: 1) goal accountability--in which the school board is accountable to the public for goal and objective selection; 2) program accountability--in which school district management is accountable to the school board for the development and/or selection of instructional programs appropriate for stated objectives; 3) outcome accountability--in which the instructional manager (i.e. the teacher) is accountable to the school district management for producing program outcomes consistent with pre-selected objectives at a performance standard appropriate for the instructional program.

This may well be a good place to start, but it is insufficient to truly take cognizance of all the parties involved in the education enterprise or of the complexities of authority, responsibility, and power in our schools. Hough (1971) points out that state statutes hold school boards alone responsible for the education of our youth but that teachers' unions have demanded and in some states received legal sanctions, and school boards find themselves legally charged to negotiate with teachers over a variety of issues concerning salary increases, fringe benefits, job security, and policy decisions. School boards, solely responsible for the operation of our schools, are in a spot. Conversely, teachers object to being held accountable for the outcome of programs without a sizable voice in policy decisions.

Moreover, state departments of education have ruled, notably with respect to contracts let to private performance contractors (to be discussed below), that school districts may not delegate authority to make policy or responsibility for management. These same departments of education enforce state regulations concerning school policy.

Students would like more influence in the formulation of school policy, and it has been suggested (Campbell, 1971) that the students themselves be held accountable for their own performance--with the acknowledgement that such a proposal would entail changes in compulsory attendance laws.

Lennon (1971) and Deterline (1968) have discussed the notion of holding developers and publishers of instructional materials responsible for the performance of students using their products and programs. Lennon points out the difficulties involved in guaranteeing to produce specific amounts of learning when producers have so little control over the use to which their materials will be put and so much depends on teacher competency and the structure of the total instructional system. Deterline acknowledges that guarantees of effectiveness are an impossible requirement to make of any instruction material to be used as one component in an instructional setting dependent on a teacher pulling together materials, media, and methods--attempting to construct a program based on materials without specified objectives or procedures for their use. But he asserts that guarantees are "exactly what the entire educational materials design and publishing field has always needed." He maintains that programmed instruction can provide such warranties and that all well designed materials should systematically include validated specifications of objectives and quality control procedures.

Accountability, then, is the object of a rather broadly based movement in public education which tends to dovetail with the influence of

systems analysis and PPBS insofar as virtually every aspect of it speaks to the issues of costs and/or effectiveness. Implicit, and often explicit, in the call for accountability is an appeal to "systems" thinking. It involves an attempt to include all participants in the educational process in an endeavor to relate output (student performance) to input (financial, material, and human resources). The relationship should specify the contribution of each resource to meeting specified objectives. Moreover, implicit (and often explicit) in the notion of accountability is the utilization of incentives. Effective contributions merit reward. Others do not. If the role of teachers and administrators can be clearly defined and their performance in these roles assessed, they can and, indeed, should be rewarded on the basis of performance--in terms of salary increase, promotion, prestige. Conversely, failure to perform entails "punishments." Likewise, incentives are evident when people like Deterline suggest that the day is coming when schools need not purchase instructional materials without guarantees. If, in fact, they did not and guarantees were available, developers and publishers of materials would be forced to compete for rewards (purchases) or suffer punishment (non-purchase).

I suggested above that educators, turning to systems analysis for assistance, might well begin to conceive of the education enterprise as a man-machine system and to favor alternatives involving the use of educational technologies. As the accountability movement is concerned with much the same issues as systems analysis, one would expect it to favor educational technologies--insofar as they can be demonstrated to contribute to the effectiveness and/or the efficiency of the operation of schools. Likewise, insofar as educators feel threatened by the accountability movement, one would expect them to oppose the use of such technologies.

# # #

There are three "movements" on the fringe of the accountability movement which are less specifically concerned with systematically relating input to output. Those people interested in promoting educational vouchers, free schools, and community control find the source of educational ills in the bureaucratic structure of our schools per se--within which they feel the needs of our youth cannot be met. These people propose alternative solutions to what they consider to be the problems of centralized administration of large city school systems and/or the uniformity of prescribed curriculum and instruction. From their respective points of view, these people go beyond holding schoolmen responsible for doing a job well to doubting it can be done--within the confines of the current structure of school bureaucracy. For further discussion of these "movements," see Appendix A.

Individualized Instruction

The bulk of the accountability movement accepts the overall structure of the schools (being perhaps less skeptical or viewing themselves as more pragmatic than the fringe "movements") and attempts to make that bureaucracy work. Efforts to be more responsive to criticism and demands have led to greater concern for individualizing instruction--to meet the different needs of individual students. There are increasing numbers of "alternative" schools being opened--the public schools' answer to free schools. These schools are intended to serve the needs of students inhibited by the traditional classroom. But the core of the accountability movement focuses on manipulating and assessing what goes on in that classroom--and affixing responsibility for output.

The literature is replete with proposals for and reports on efforts to systematically relate input to output and individualize instruction

within the regular classroom as a means of doing so. A look at a representative sample can give us a better idea of what they are about.

Structuring Programs Around Specified Objectives

A cooperative Service Agency in Wisconsin is operating a Title III project entitled "Individualizing Instruction Through Media--Rural," encompassing thirteen rural districts with 92 teachers, 31 paraprofessionals, 26 clerical assistants, 2760 students. Pupils work on contracts which specify objectives and materials suited to their individual needs, prepared by teachers trained to prepare instructional objectives in behavioral terms, design instructional sequences to individualize learning, and use media. A wide array of media is utilized, particularly in the areas of language arts, science, and math, including the following hardware (with appropriate software): 16mm film projector; filmstrip projector; individual filmstrip viewers; slide projector; overhead projector; tape players, with headsets and jackboxes; cassette tape recorder, with headsets and jackboxes; language master. Much of the software is made available through the Instructional Materials Center at La Crosse via a truck route serving each school twice a week. There are also facilities available at each school for local materials production. Each student is instructed in the operation of all equipment which is then made available to him for use on his particular contracts. Pre-test performance determines assignment of contracts, which in turn specify the criterion performance of required proficiency necessary on post-tests before proceeding to the next skill or concept (next contract). The project, enthusiastically received by students, parents, teachers, and supervisors, has had a significant impact on learning, as evaluated by the Wisconsin Department of Public Instruction after the first year of operation. (Solberg, 1970)

The Learning Research and Development Center of the University of Pittsburgh, funded by the U. S. Office of Education, has developed Individually Prescribed Instruction (IPI) which, with a few variations, looks much like the Wisconsin rural project. It is designed to provide for individual differences in children through the use of a variety of instructional settings, programmed materials, self-instruction, and multi-media modes of instruction. Like the Wisconsin project

> The developmental model for IPI considered the following aspects of instruction as they related to the individual: (1) detailed specification of educational objectives; (2) organization of methods and materials to attain these objectives, including a variety of paths for mastery of any given objective; (3) a procedure for the diagnosis of student achievement in terms of the educational objectives; (4) individual daily evaluation and guidance of each pupil, including a system for individually prescribing the learning task that the student is ready to undertake; (5) provision for frequent monitoring of student performance in order to inform both the pupil and the teacher of progress toward an objective; and (6) continual evaluation and strengthening of curricular and instructional procedures.
> (Scanlon and Brown, 1971:95)

Like the Wisconsin project, IPI makes use of teacher aides to help with grading and paperwork. The main differences seem to be that IPI does not use contracts with students (which tend to run from three to five days) but rather evaluates pupil progress daily; that IPI relies less heavily on media; and that although the IPI teacher daily uses data to prescribe individual learning tasks, self-instructional materials and teaching sequences were apparently organized by the Learning Research and Development Center.

With the cooperation of Research for Better Schools, Inc., IPI has been field tested in five demonstration schools, serving different student populations, e.g. disadvantaged, rural, special education, Indians, Mexican-Americans. Scanlon and Brown (1971:104) report that students and teachers have positive attitudes toward the system and that "IPI students achieve as well or better than non-IPI students on

standard tests." These demonstration schools have hosted thousands of visitors interested in individualized instruction. To help meet the needs of those interested in establishing IPI in their schools, Research for Better Schools, Inc. and the Learning Research and Development Center have devised a strategy for the training of administrators and paraprofessionals, the retraining of teachers, and the monitoring of these schools to assess the degree of implementation of IPI and the progress of students.

Scanlon and Brown report that the costs of IPI have been decreasing, citing a 200% reduction in mathematics materials (without, unfortunately, specifying what those materials are or comparing the cost to non-IPI schools). But they note that

> Mass adoption of the IPI system will necessarily involve publishers and other commercial sources. State laws in many cases will have to be modified to accommodate the IPI system. State approved textbooks and purchasing procedures will also need modification. The purchase of consumable items, the payment of teacher aides, and the provision for retraining funds are some of the other obstacles that must be overcome if Individually Prescribed Instruction is to be available on a national scale. (Scanlon and Brown, 1971: 104-5)

Computer-Managed Instruction

Programs of individualized instruction, such as the Wisconsin "Individualized Instruction Through Media--Rural" and IPI, involve assessing the needs of individual students, specifying behavior objectives appropriate to those needs, prescribing materials and procedures designed to meet those objectives, monitoring student progress toward objectives--all of which requires the systematic collection analysis, and display of data on student performance and appropriate materials for prescription. Such a task can consume large amounts of time on the part of teachers and/or paraprofessionals.

Some programs are making use of computers for data-processing, including at least one IPI school. Valuable staff time is then freed to attend to the needs of the students, basing instructional decisions on the diagnostic and prescriptive information provided by the computer. Moreover, the use of computers facilitates the consideration of a wider array of data on student characteristics, beyond current academic performance. (Silberman, 1969)

John C. Flanagan (1968), Chairman of the Board, American Institutes for Research, and Verne S. Atwater (1972), President, Westinghouse Learning Corporation, have reported on the cooperative effort of their respective institutions in the development and distribution of a computer-managed instruction (CMI) system called the Program for Learning in Accordance with Needs (PLAN). Flanagan reports that

> Project PLAN represents a systems approach to educational problems. By "systems approach" it is intended to indicate that all the relevant factors in the situation are considered and not just selected aspects. In other words, the whole problem rather than some portion of it will be treated. (Flanagan, 1968:113)

Project PLAN is designed to utilize resources currently available to schools serving all types of students in a program of individualized instruction based on guidance and individual planning to aid the student "to develop plans which will enable him to prepare himself for those roles that he wishes to play in society" (Flanagan, 1968:115). It encompasses the teaching of mathematics, language arts, social studies, and science for grades one through twelve. There are five major components of Project PLAN:

1) The computer processes data to be made available to teachers and administrative personnel to aid in decisionmaking.
2) Behavioral objectives specify changes in behavior to be produced (terminal behavior), usually grouped in two-week modules, indicating to student and teacher what the student is to learn during that period of time in any given subject matter.

3) Performance standards (criterion tests) correspond to the behavioral objectives.

4) A guide, the teaching-learning unit, is given to the student and teacher, indicating the objectives, materials to be used and how to use them, and how to check for the achievement of desired behavioral changes. The guide is intended to provide suggestions, but the student is not obliged to follow them. He must merely demonstrate learning by meeting performance standards.

5) Guidance and individual planning units and tests determine the student's abilities, his learning style, his plans and potentials for future activities and roles. Those, combined with occupational information integrated into the instructional program, help the student to understand himself and learn to make realistic choices. In twelve years of schooling, a student will have chosen about 1200 of 5000 available modules. Of course, this decisionmaking is informed by the data-processing function of the computer, which (in addition to scoring, record-keeping, scheduling) compares student and materials and recommends short- and long-range steps, providing alternative teaching-learning units suited to the student's learning style. (See Flanagan, 1968)

Atwater (1972) reports that, after three years of development and testing in fourteen school districts with 10,000 students, Project PLAN now involves some 20,000 students throughout the country. He notes that student interest increases with responsibility, teachers have a new sense of professionalism (training and consulting services being available), and administrators "can account to parents and taxpayers for both the costs of

education and the progress of individual students." Space and materials are more effectively used, and funds for counseling and remedial work are freed for other purposes, as these activities are incorporated into the regular classroom. Moreover, the data-processing function of the computer facilitates the evaluation of the relative merits of specific teacher-learning units for given types of students, the value of computers, television and other hardware (and software) available for instructional purposes. (Atwater, 1972; and Flanagan, 1968)

John F. Cogswell (1966), of the System Development Corporation, has reported on an instructional management information system being designed in conjunction with their analysis of the Continuous Progress Plan (CPP) developed at Brigham Young University Laboratory School (grades seven through twelve). Their study of CPP was a part of research into the implementation of instructional media through systems analysis and computer simulation.

CPP is based on the use of "Study Guides" which specify all required work for a given course. The student works individually on texts or programmed instructional materials obtained from the Instructional Material Center. Teacher aides monitor study areas, providing routine assistance. Students needing further help file requests by describing their problems on forms which are analyzed daily to form homogeneous groups for group-help sessions. Over time, the size of the groups decreases as the variation among students increases. Students determine when they are ready to be tested on a unit of study, file requests, and are assigned to the continuously operating Test Center. Those who pass progress to the next unit; those who do not do further work before re-testing. The latter happens (ideally) infrequently, as students set rate and achievement "expectancies" (based on their past records) with the aid

of counselors.

To keep CPP working smoothly, the instructional management information system designed by System Development Corporation keeps a daily record of all scheduled activities, ensuring that appointments are kept and that equipment is ready, used, and returned. But central to the data-processing function of the computer is the "surveillance and detection system." Teachers, aides, students, counselors, and administrators use teletype stations to insert the following information into the computer's student-information data base:

1) Biographical data.
2) Students' past performance; achievement test scores on course work and the dates of testing.
3) Reports filed by teachers and aides on the student's interests; learning, emotional, and social problems.
4) Requests for materials, classes, and extracurricular activities filed by the student.
5) Student's schedules and "expectancies" for course work.
6) Records of counseling interviews.
7) A long-term schedule of "major events" in the student's high school career, e.g. vocational-planning interviews, college placement discussions, etc.
8) A record of the degree to which the student's current interests and activities are consistent with original goals set earlier.

The information logged in the computer at any given time forms predictive criteria against which student progress can be compared. Periodically the computer scans the data, making judgments about the degree to which the student is meeting "expectancies." Discrepancies result in "red flags" inserted in the student's file, signaling the need for attention, whereupon

the computer produces a display of specified problems which it routes to appropriate personnel (and possibly to the student, "containing carefully selected data"). Problems might include failure to take a scheduled test or to pass it, failure to appear at group sessions, or a discrepancy between current interests and activities and long-range goals set earlier. After the appropriate staff member meets with the student, he enters at a teletype station a record of the interview and its results, including any adjustments in schedules or expectancies. Should the computer find the student to be meeting schedules and expectancies, it merely records this information in his information file. However, it is felt that no student should go too long "without some fairly structured and regularized contact" with a staff member. If the computer finds no such recorded meeting, it sets a red flag on his file to alert the staff to the need for appropriate action. (Cogswell, 1966a and 1966b)

Cogswell sees great potential for a fully developed surveillance and detection system:

> Such a system would be capable of special sensitivity to students whose difficulties were extreme or nearly continuous; in the files of these students, a single red flag would route a direct warning message to the appropriate counselor...The system would provide, and encourage the use of, easy ways for the students to express their own needs, reactions, and interests. In short, such a system would approximate the awareness and interest of a dedicated teaching staff whose whole "student body" consisted of a single pupil.
> (Cogswell, 1966a:101)

Computer-Assisted Instruction

We have observed that the call for accountability has led to greater concern for meeting the different needs of individual students. Attempts have been made to set behavioral objectives in terms of the interests and/or needs and abilities of the individual child. Some are utilizing the data-processing capability of computers for record-keeping, scheduling, and

instructional prescription in the management of individualized instruction --freeing staff members for individual attention to the counseling and tutorial needs of students. Others are attempting to use the computer for the delivery of instruction itself. Gabriel D. Ofiesh, who played a major role in the development of the U. S. Air Force's programmed learning methodology, has defined computer-assisted instruction (CAI) thus:

> By "computer-assisted learning," we mean using a computer to present materials to human organisms by driving display devices, such as typewriters or projectors or tape recorders, etc., to help students understand concepts by performing problem-solving calculations and simulating real-world situations.
>
> It is assisting the student learning process and therefore is called "computer-assisted instruction" (CAI)...CAI is a man-machine relationship in which the man is a learner and the machine is a computer system with a purpose of inducing human learning and retention.
>
> Another point that should be made--it is fundamental and rather axiomatic--is that computers can only process data that is put into them. Computers do not think, feel, or create new information.
>
> (Ofiesh, 1968:59)

Hall (1971) has distinguished four uses of computers in education: 1) Laboratory computing device: Students have direct access to the computer as a tool to develop programs related to their course work, primarily in mathematics, physics, and chemistry. Hall estimates that there are some 500 high schools in this country utilizing computers thus. 2) Record-keeper and retriever: The computer is used for administrative purposes and those we have delineated for CMI. 3) Simulation: This use of computers has been centered in higher education in the field of medicine, where computers have been variously used to simulate "patients" for whom the student provides a diagnosis. 4) Tutor: It is this use to which the literature msot commonly refers as CAI. The computer might be used for drill and practice exercise or it can become the primary source of instruction, providing sequential exposition of programmed materials.

Hall notes the peculiar advantages of CAI for individualizing instruction: A student working at a computer terminal is actively responding to the

material presented to him. It precludes the passive role of students exposed to traditional uses of texts (or oral or visual presentations)--often cited as a particular problem of slow learners. While the student is actively responding to the material, a computer delivering a pre-stored program can evaluate and provide feedback to the student's response in a matter of seconds:

> Results to date show that students receiving instruction from computers respond anywhere from once every four seconds to once every 30 seconds. This means that each student. . . is responding and receiving feedback from 40 to 600 times during a 40-minute session at a computer terminal. (Hall, 1971:628)

The speed of the evaluative and feedback functions of the computer permits the immediate alteration of a course of study in accordance with the immediate past history of a given student to achieve pre-determined criterion performances. (Hall, 1971:628-9) Moreover, Hall reports that

> a consistent result in the use of computer-assisted instruction has been that the same amount of material has been learned in a CAI environment as in a conventional classroom, although with a considerable saving of time in favor of CAI. (Hall, 1971:630)

Such a saving in time could be of considerable value, particularly to those interested in improving the performance of today's low-achieving slow learner.

With respect to costs, Hall maintains that the costs of CAI are comparable to those of conventional instruction and that rising personnel costs and decreasing technology costs make CAI an attractive system to school administrators. He suggests that the possibility of utilizing a computer for daytime delivery of CAI to students, for in-service and adult education after school and in the evening, and for administrative purposes from midnight to 8:00 a.m. make the installation of such a system economically feasible in many school districts and gives it a competitive advantage over conventional instruction. (Hall, 1971:630-1)

Assessing Accountability

Assuming that goals are defined, there are essentially two distinct aspects of assessing accountability. First, students must be tested to determine the extent to which their behaviors meet goals. Given appropriate measures evaluating student performance, a determination must be made of the factors influencing that performance, to evaluate the extent of the influence of school programs and personnel. As yet, there are no well-defined agreed-upon procedures for performing either of these tasks--to relate input to output.

The primary issue in the testing of students concerns the nature of the testing instrument, the implications of using one type of test as opposed to another, and their relative validity under certain conditions for certain purposes. The determination of factors influencing performance on any given testing instrument is itself a complex task, partly because of issues relating to the testing and partly because of the need to identify and quantify influences over which educators presumably have no control and for which they therefore have no responsibility. These, ranging from the child's IQ and socio-economic status to community and school plant conditions would be held constant to isolate the influence of school personnel and programs.

Data generated from the use of such techniques should have valuable policy implications. Beyond the possibility of refining personnel selection, assignment and remuneration policies, such data should also lend itself to an evaluation of the relative cost-effectiveness of alternative programs of resource allocation--including the educational technologies.

It is true that the entire area of testing and measurement--determining what a student has learned and what factors account for that learning--is in somewhat of an embryonic stage. But the controversy generated by the account-

ability movement has stimulated interest in it and will likely contribute to its development. For further discussion of the issues involved in testing and proposals for determining accountability (some of which are being implemented), see Appendix B.

PPBS in Public Education

We have noted that many of the issues involved in the accountability movement are not unlike those Mr. McNamara hoped to deal with when he introduced PPBS and systems analysis into the Department of Defense. Both reflect a concern with achieving specified objectives, determining the degree to which those objectives are being met and the cost of doing so. The goal is to assure that policies are being carried out effectively, and efficiently, and to have the knowledge at hand to make intelligent decisions on alternative courses of action. We might recall that Stockfisch commended the use of PPBS to executives charged with managing such bureaucracies as the public schools. And, indeed, President Johnson was sufficiently impressed with the operation of PPBS in the DoD to issue a presidential directive in 1965 mandating its use by all federal agencies--including the Office of Education.

Since that time, there has been a spate of literature relating the advantages of PPBS and its application to specific school problems. State legislatures, following the federal lead, have been most responsive--80% have either mandated or considered its use in the public schools. And some administrators have already taken steps to implement it in their local districts, including those in Los Angeles, Chicago, St. Louis, Philadelphia, Baltimore and Memphis.

The Rand Corporation has been instrumental in developing plans to implement PPBS in California (Farquhar, 1971). And Rand analysts have produced a series of papers on its purposes and methods and the exigencies of

applying it to public education. Haggart has delineated The Program Structuring Aspect of PPBS for Education (1971) and Carpenter has explicated the Analysis of Educational Programs (1971) and Cost Effectiveness as an Aid to Making Decisions in Education (1970). The point is first to indicate the disadvantages of the traditional budgeting systems, which merely list "instruction" as a line item followed bya a lump sum--perhaps broken down into subjects taught--without supplying any information about what those figures mean in terms of what is happening in "instruction." By contrast, the advantages of PPBS are presented in terms of a program structure relating activities (and their resources) to measurable objectives; these objectives broadly stating goals, are broken down into sub-objectives (in behavioral terms) of subprograms. The budget not only indicates the costs of what people are doing to achieve objectives, but projects those costs into the future. PPBS, then, is more than an accounting system. It provides decision makers with the information they need to evaluate and select from alternative programs on the basis of their cost-effectiveness.

Putting PPBS into effect is dependent upon the existence of a rather elaborate information system. And Rand analysts have produced a six volume study, designing such a system for the management of the Los Angeles school district. (Farquhar, et al., 1971)

One would expect that schoolmen putting PPBS into effect will make judgments about educational technologies in terms of their relative cost-effectiveness.

III. BEHAVIORIST LEARNING THEORY--CAN DO

We noted in Chapter I the existence of technology and the use of systems analysis and incentives in the military/space sphere. We have seen the latter echoing throughout the accountability movement and the utilization of technology (conventional A-V equipment, CAI, CMI) to individualize instruction as a means of achieving accountability. All three of these influences on education are buttressed by a behaviorist theory of learning.

In that chapter on the influence of our military/space efforts, we made mention of a volume prepared by the Aerospace Education Foundation, entitled Technology and Innovation in Education. It is fitting that the forward to this book should have been written by B. F. Skinner, whose early work included training "missile-guiding pigeons" for the Air Force in World War II. Skinner's name has since become synonymous with behaviorist learning theory. He is the recognized "father" of programmed instruction.

> It is significant that the Air Force and the Aerospace Education Foundation are working closely with public education. The historian of the future, in writing about education today, will undoubtedly note, and will probably be puzzled by, the fact that technological advances in education have been picked up much more rapidly by industry and the services than by our schools and colleges.
>
> There are some obvious explanations.
>
> . . . . . .
>
> But the reason most often given is a supposed distinction between training and teaching.
>
> It is often said that industry and the armed services can use programmed instruction because they are interested in training and that programmed instruction is therefore appropriate. But what does training mean?
>
> The first step in constructing a program is to decide what you want to do. You must define the terminal behavior. What is the student to do as a result of having been taught? Only when you know that can you arrange conditions under which he will acquire that behavior.

> In the armed services and in industry we usually know what we want the student to do, and we know when he has learned to do it.
>
> In schools and college the situation is very different. No one has defined the terminal behavior. No one has specified precisely what the student is to do as the result of being taught.
>
> The distinction between training and teaching comes down to this: If you know what you are doing, you are training, and if you don't know what you are doing, you are teaching. (Skinner, 1968a:v)

Skinner's behaviorist learning theory is grounded in a firm belief that man <u>is</u> his behavior and that behavior is shaped solely by what happens after it takes place, by how it is reinforced. Behavior followed by negative reinforcement will result in aversive future behavior. Behavior followed by positive reinforcement will tend to be repeated in the future. His work with animals, young children, and mental retardates has led Skinner to believe that it is possible to teach any behavior if we can define it, analyze it, and control the conditions under which it occurs. To critics who maintain that one cannot teach insight and creativity by programming, Skinner answers that if they would just define "creativity"--how does a creative person behave?--the behavior could be analyzed and contingencies of reinforcement arranged to produce that behavior.

> The whole process of becoming competent in any field must be divided into a very small number of very small steps and reinforcement must be contingent upon the accomplishment of each step. (Skinner, 1968b:21)

And then Skinner takes note of human limitations.

> These requirements are not excessive, but they are probably incompatible with the current realities of the classroom. In the experimental study of learning it has been found that the contingencies of reinforcement which are most efficient in controlling the organism cannot be arranged through the personal mediation of the experimenter. An organism is affected by subtle details of contingencies which are beyond the capacity of the human organism to arrange. Mechanical and electrical devices must be used. Mechanical help is also demanded by the sheer number of contingencies which may be used efficiently in a single experimental session. (Skinner, 1968b:21)

While there are those within the behaviorist camp who differ with Skinner over the forms of programming--linear or branched--and those who do not limit themselves to the kind of teaching machine he specified, the notion of programming instruction by breaking down the task and rewarding appropriate behavior is a powerful and growing force in education. To those who would attempt to discredit programmed instruction on the grounds that it has proven no better than conventional instruction, Skinner would answer that those programs were based on poor analyses of the behavior to be shaped and that better analyses would lead to better programs and schedules of contingencies of reinforcement--and better shaping of behavior. And, indeed, for many educators, this remains the ideal--particularly among those in educational technology. We have seen its influence on computer-assisted instruction. And the literature on instructional television indicates a similar influence. (Kaplan, 1972)

The behavioral technology exemplified by Skinner's work promises to fill the knowledge gap made so obvious by the efforts of accountability advocates to design educational systems made up of programs relating output to input. For invariably we return to the same question: What should we be doing to improve student performance?

Skinner reminds us that Sidney Pressey designed a machine that could teach in the 1920's, but without a concomitant behaviorist theory, the invention was essentially ignored. We might add that neither was there a vast technological and systems analysis capability developed by a military/space effort for which civilian applications were sought. Nor was there a climate of accountability, with forces at work in education striving to relate inputs to outputs. Today there is.

IV. PERFORMANCE CONTRACTING--TELLS ALL

Much of the literature on accountability is concerned with better management; specifying behavioral objectives, the performance of which can be demonstrated; developing measures of output (student behavior change) and measures of the degree to which school personnel meet their responsibilities. Less attention is given to determining what personnel should be doing in terms of process specifications.* Part of this is due to the early stage in which we find the accountability movement, and is the result of a conscious desire on the part of accountability advocates to shift from a traditional emphasis on methodology to a new emphasis on output--not how the teacher teaches but what the student learns. Unfortunately, it is not that simple.

For instance, we can employ a technique comparable to Barro's suggestion of a multiple regression analysis in a given school district.** We might determine in a hypothetical situation that output measures (of student performance) are less than specified by objectives, but that the failure cannot be attributed to teacher performance. Rather the fault lies with the program of instruction and the supervisory personnel charged with its development. Such a discovery is certainly a valuable clue to administrators that they need to develop better programs. Still, one cannot help but step back and ask, "So, what else is new?" What have we learned that we did not already know? For was it not our failure to develop effective

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* We might call this task operations research, as would be performed by a systems analysis staff evaluating alternative approaches to achieving given behavioral objectives; or behavioral analysis, as would be performed by a Skinnerian to construct appropriate programs of instruction and contingencies of reinforcement to achieve those objectives.

** See Appendix B.

instructional programs (at least for low-income, low-achieving students) that, in part, generated this new accountability movement?

In an attempt to cut through many of the problems attendant upon efforts to make accountability work and, indeed, to make Every Kid a Winner, Leon Lessinger (1970) has become the leading advocate of performance contracting. Acknowledging the difficulty of stating many educational goals in terms of behavioral objectives which are measurable, Lessinger stresses that we can do so for such basic skills as reading and arithmetic--which are, after all, the crucial areas in which low-income and minority students perform poorly. He advocates local educational authorities drawing upon outside talent and resources to engage in a kind of "educational engineering." His approach is designed to encourage low-risk experimentation in order to find that mix of instructional technology--hardware, software, incentives, methods--that produces specified results. While school districts across the country would benefit from the testing of a variety of programs, performance contractors would be paid on the basis of guaranteed results.

> But what exactly does performance contracting involve? In order to use it effectively, a local education authority forms temporary alliances with several outside agencies. First, it needs a source of funds earmarked for educational development. School districts that are both prosperous and farsighted can raise some of this money from their own local budgets, but most districts will depend heavily on grants from state and federal agencies.
>
> Second, performance contracting requires a management support group that can help local officials specify exactly what educational results are sought; in writing a request for bids from firms willing to do the job; in negotiating with and evaluating these firms; in drawing up the contract; and in dealing with the chosen firm.
>
> Third, the local authority needs the services of an independent educational auditor who will assess the children before and after the program and make a public report. This report will determine whether the contractor has met all of the requirements and, if so, whether he is entitled to the incentive payments for exceeding the minimum standards.

> Last, but hardly least, the plan requires that various firms or other groups bid vigorously for the contract, tailoring their resources to the stated needs of the local school. (Lessinger, 1970: 18-19)

A number of school districts have elected to utilize performance contracting to experiment with new programs in an effort to find that combination of resources which will be successful with students who have traditionally been failed by our schools. After the much publicized first contract was let in Texarkana, the Office of Economic Opportunity implemented a one-year "test" of performance contracting in the schools, "the largest field experiment conducted in a single year in the history of public education in the United States." (Blaschke, 1971b:1)

I have attempted to delineate in this paper certain forces operating on the public schools which might be conducive to their use of technology: the availability of that technology, systems analysis (including cost-effectiveness), the use of incentives, the accountability movement, behaviorist learning theory. It is possible to view OEO's test of performance contracting, perhaps the most extreme response to calls for fiscal and pedagogical accountability, as the embodiment of these influences. The experiment itself was a form of systems analysis, designed to evaluate the relative cost-effectiveness of existing techniques of teaching offered by educational technology firms. Technology firms were to be evaluated on the basis of their ability to provide the alleged advantages of performance contracting, including

> ----Improving the reading and math skills of poor, under-achieving children through the use of incentive-based contracts.
> ----Reducing the costs of increasing a child's achievement by certain grade levels.
> ----Effecting institutional change by introducing new techniques and instructional devices into the classroom, and by developing an awareness among school officials of the need to establish educational objectives and determine whether those objectives are being met. (OEO Pamphlet 3400-5, 1970:6)

While performance contracting is, by definition, incentive-based, OEO utilized incentives from the inception of the experiment, insofar as participating school districts and educational technology firms competed for inclusion in the experiment. While OEO was influenced by the need to assure representation of the major types of low-income, low-achieving populations in the country, to be rewarded with selection

> the school districts had to meet the following criteria:
> --Designate elementary and junior high schools for the experiment that met the criteria for assistance under Title I of the Elementary and Secondary Education Act.
> --Have at least 200 children each in grades, 1, 2, 3, 7, 8 and 9 (100 for the experimental group and 100 for the control group)[2]
> --Be able to provide data on student achievement and to provide space and personnel for the experiment.
> --Indicate that it anticipated no legal or political obstacles to mounting the experiment.

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[2] This criterion was reduced to 75 students in three cases to allow small, rural districts to participate in the experiment. (OEO Pamphlet 3400-5, 1970:7)

Eighteen school districts were chosen: four large urban systems, nine middle-sized urban systems, and five smaller rural systems. They represented poor Whites, Blacks, Chicanos, Puerto Ricans, Eskimos, and American Indians.

> Of the 31 technology firms responding to the OEO's request for proposals, six were selected on the basis of their corporated experience and interest in performance contracting, the types of achievement they thought they could guarantee, the qualifications of their staff, and the variety they represented in terms of their instructional approach (i.e., emphasis on hardware, incentives, or curricular software and teacher training methods).
> (OEO Pamphlet 3400-5, 1970:8)

Each company was assigned to work in three demographically varied districts among the eighteen. Payment was based on a guarantee of a minimum level of improvement in each subject in each grade for each individual child, not class or site averages. Additional payments were to be made for improvements beyond the minimum. Some contractors passed on the incentives

to teachers using some form of merit pay.* All but one contractor extended the use of incentives to their students, whose contingency management included reinforcement in the form of tangible gifts, money, free time, games, movies, trips for free hamburgers and milkshakes. While a variety of resource mixes were demonstrated, all contractors utilized programmed instruction; and all employed paraprofessionals to a greater or lesser degree. (Blaschke, 1971b)

OEO let separate contracts to the Battelle Memorial Institute to provide the educational achievement evaluation and to Education Turnkey, Inc. for management support.

> Two sets of tests were used in the experiment, one for determining the private firms' pay and one for OEO's evaluation purposes. Three different, nationally normed standardized tests, one of which was selected on a random basis for each class, were used for determining about 75 percent of the firms' pay, with the remainder of the pay determined by students' performance on criterion, or curriculum, referenced tests. A fourth standardized test was used only for evaluation purposes. (OEO Pamphlet 3400-5:11-14)

Stringent measures were taken to preclude the possibility of "teaching to the test," safeguarding results obtained from standardized tests. Recognizing the difficulties involved in measuring educational growth,** Battelle evaluated differences between experimental and control groups on pre- and post-tests in reading and arithmetic, fitting data for each grade/site combination to a regression model based on raw scores (not the grade-equivalent scores upon which payment to contractors was determined). Their summary of results for each grade/subject/site combination indicates that there were 31 significant positive impacts, 54 significant negative impacts, and in 127 cases, there was no significant difference between experimental and control groups.

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* The contractor operating in Texarkana, not included in this experiment, had offered stock in the company among its teacher incentives.

** See Appendix B.

It is unfortunate that, given the intent of the experiment to test a variety of combinations of educational resources, no attempt was made to relate the various programs to the six performance contractors and their specific combinations of elements to the measured output. Why did Seattle have no cases of positive impact, 9 of negative impact, and 3 of no significant difference; whereas Anchorage had two cases of positive impact, none negative, and ten of no significant difference; and Dallas and Jacksonville both had six, zero, and six, respectively? What is it about the programs in third grade arithmetic that produced more negative impacts than any other grade/subject combination? What is it about the programs in seventh and eighth grade arithmetic that can explain the fact that they succeeded nowhere in achieving a positive significant difference, but that five such differences are found in third grade arithmetic? (See Battelle, 1972:85) It would be most valuable to have an analysis relating specific combinations of inputs to the measured output, especially in those cases where significant positive impact occurred. Unfortunately all we can say is that, in most cases, there was no significant difference in educational output between experimental and control groups.

More useful are the results of Education Turnkey Systems' economic analysis, indicating that fourteen of the grade/subject/site experimental programs had lower costs per student-year than their corresponding control programs. Of these fourteen, only three actually had lower costs at rates per hour of instruction than corresponding control programs, the remaining eleven having consumed less instructional time. (Blaschke, 1971b:181) This raises rather interesting questions about cost-effectiveness: If the eleven programs achieved no significant educational difference in less time, would they have done so in the same time? Are they more effective for having achieved no significant difference in less time? Time is no

minor factor for students in compensatory education programs because they are slow learners. Such data on costs and effectiveness are of particular interest in light of Education Turnkey System's final comments on their economic analysis:

> In general, the experimental programs were able to demonstrate the following:
>
> - lower classroom costs through better scheduling
> - lower staff costs through the use of paraprofessionals* and more intensive scheduling
> - reliance on individualized instructional systems (with a concomitant increase in audio-visual hardware and software cost).
>
> All of these characteristics have two things in common: the qualities of management control and flexibility. These qualities allowed each subcontractor to more effectively use the educational resources that went into each program. This improved management of scarce resources is possibly the most important prerequisite for realization of any benefit from the advances in educational technology. And these advances include, not only sophisticated hardware systems, but also the behavioral science advances as reflected in this experiment.
> (Blaschke, 1971b:182)

The Rand Corporation has done a separate evaluation of performance contracting for the Department of Health, Education and Welfare in a series of eight case studies (including only one site from the OEO experiment). Their findings, based on preliminary reports of disputed** gain scores indicate respectable but not dramatic results. And, corroborating Education Turnkey System's economic analysis, they find that

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* The report later notes that there were some "states which required that the classroom be under the supervision of a regular licensed teacher" but the contract program provided by the Office of Economic Opporunity did not specify their use. In such cases, the subcontractors were obliged to hire such staff although they were not needed, thus increasing their costs and distorting somewhat the purpose of the experiment. (Blaschke, 1971b:201-2)

** See Appendix B.

(although performance contracting costs more than conventional instruction) when measured against comparable compensatory educational programs, performance contracting costs were the same or less. Moreover, they report that those performance contractors who spent less on certified teachers and more on paraprofessionals, materials, and equipment were the cheapest. (Carpenter and Hall, 1971)

The data on performance contracting is not inconsistent with Donaldson's (1971) review of the literature indicating no significant difference between conventional instruction and the use of instructional television,* teaching machines, and programmed instruction. And Pincus' review of Rand studies in educational technology includes research done for the Air Force in which

> the Rand team is developing tools for designing instructional systems and analyzing the impact of varying designs on the resources required for, and the costs of, instruction. Early results have shown that substantial savings in the costs of instruction are possible with no decrease in training effectiveness. (Pincus, 1971:11; see also, Bretz, 1971)

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* There is the notable exception of the mandated instructional television system in Hagerstown, Washington County, Maryland. The effect of ITV there has been remarkable. During the first year of its use, grade 5 students gained an average of 1.9 years in knowledge of arithmetical concepts. "In junior high school general mathematics, the average level of urban pupils . . . rose in four years . . . from the 31st percentile on a standardized test of concepts to the 84th percentile . . . and on a standardized test of problem-solving from the 33rd to the 68th percentile." Of particular interest are results of an experiment directly comparing the ITV system with classroom-only instruction, indicating that children of less than 90 IQ (average 83 IQ) gained only 6 months in achievement growth in a year with classroom-only instruction but 13 months with ITV. (Schramm, Coombs, Kahnert and Lyle, 1967:68-69) Of course, the results here are strikingly different from the bulk of the literature reporting no significant different between ITV and conventional instruction (teacher-led, classroom-only). The task remains to determine what makes Hagerstown different and/or develop other instructional programs equally effective.

Moreover, Pincus continues:

> These results imply that the development of techniques for instructional system design can radically improve the effectiveness of instruction in almost any context....Unfortunately, it has....become clear that those planning and designing instruction have only crude means at hand.
>
> To help remedy this situation, Rand is developing a computer program to examine the use of communication media systems in instruction designed for any type of subject matter or student. This program will develop ways of integrating media systems with other elements of instruction based on criteria of cost, practicability, and conformity with instructional strategy.
>
> (Pincus, 1971:11-12, emphasis added)

Reduced costs, even provided no significant difference in output, is an attractive feature of educational technology to school districts hardpressed for funds. Moreover, education delivered through such media as instructional television and computer-assisted instruction can reach considerably more students than any given "good teacher." Should instructional systems using communications media be developed which "radically improve the effectiveness of instruction," the use of such technology will be especially attractive. And, the more widely utilized the technology, the cheaper it becomes. It would seem that school districts, faced with demands for fiscal and pedagogical accountability, perhaps instituting PPBS or located in states that are doing so, would be strongly influenced to embrace educational technology.

V. COUNTERVAILING FORCES AND SOLUTIONS: POWER AND MONEY--WILL DO?

The accountability movement has not been well-received by teachers. To the contrary, a recent Teacher Opinion Poll reported by the NEA Research Division indicates that the closer to home accountability strikes, the greater the teacher opposition. The report reveals that 48% of teachers polled opposed performance contracting, 71% opposed a voucher plan, and 88% opposed accountability payment, "whereby teachers would be paid on the basis of their pupils' achievement." The NEA researchers conclude that

> the results of this survey strongly suggest that public school teachers in general do not believe that the type of competition for money customary in the business world should be applied to education. (NEA Research Division, 1971:13)

If we posit that responsibility is meant to accompany competition for funds in the accountability movement, and if we substitute the word responsibility for "competition for funds," we find that as responsibility moves from an outside agency to the school and then to the teacher, teachers' temperatures rise.

But we should not be deceived by the 48% opposition to performance contracting, for contractors are employing practices, including the merit pay receiving 88% opposition, which pose a grave threat to teachers. The Grand Rapids Educational Association, although otherwise cooperative with the contractor in its district, strenuously objected to the use of merit or incentive pay--in this case, bonuses for some teachers. (Sumner, 1971) The Gary Teachers Union had a number of grievances, including the increase in pupil/teacher ratio, the use of paraprofessionals (who they maintained served as teachers), and differentiated staffing and salary

rates amounting "to a hidden merit or incentive pay system." (Hall and Rapp, 1971)

Indeed, Myron Lieberman, noting that 70% of the teachers in this country were covered by collective negotiations in 1971, suggested among developments likely to predominate in the collective negotiations of the 1970's the following:

* An intensive effort to organize paraprofessionals in education.
* Greater negotiating and legislative emphasis upon organizational security, especially agency shop clauses.
* A growing concern with performance contracting, voucher systems, and other institutional changes that appear likely to undermine traditional employment relationships in education. (Lieberman, 1971:215-216)

In fact, the American Federation of Teachers has already flatly rejected performance contracting and the NEA has made acceptance of contracting and other forms of accountability contingent upon teacher self-governance. (Williams, 1971)

It is not surprising that an educational technology that could reduce costs through greater reliance on equipment and paraprofessionals and less on expensive certified teachers should generate teacher opposition, especially during a time of marked teacher surplus. Thus, William Graybeal, assistant director of the NEA Research Division, discussing the prospect of having three teachers on the labor market for every available job by the fall of 1972, suggests that we would have a teacher shortage, if we concentrated on such goals as raising the quality of education by decreasing the pupil/teacher ratio. (Graybeal, 1971) This despite the fact that there is no evidence to indicate that pupil/teacher ratio makes any significant difference in student performance. It should be noted, however, that the cost-effectiveness measures demonstrated by performance contractors did not preclude individual attention

to pupils' needs; to the contrary, many contractors drastically reduced pupil/staff ratios by increased employment of paraprofessionals, sparing the cost of expensive certified teachers necessary to reduce pupil/teacher ratios.

Nor is it surprising that NEA's bid for self-governance should make the following point: "Board standards for employing qualified staff can be developed. These standards might reflect a higher level that the minimum certification requirements of that state" (Williams, 1971:60). This despite the fact that Hanushek finds in his study of The Value of Teachers in Teaching that

> the present set of hiring practices leads to an inefficient allocation of resources. The analysis indicates that teaching experience and graduate education do not contribute to gains in student achievement scores. Moreover, the characteristics that do matter are not highly correlated with these factors. Yet these attributes are being purchased by the school district. (Hanushek, 1970:25)

Distorted information is one of the tools used by line agencies to elude the direction of executives and impede attempts to change policy in bureaucracies, discussed by Stockfisch (1970) in his paper on the introduction of PPBS into the Department of Defense. The educational system seems not to be immune to such practices. Stockfisch mentions another tactic, which has apparently proved successful for teachers--the development of a constituency independent of the executive. Thus, Charles Blaschke's* analysis of a recent Gallup survey reveals a not so curious array of sentiments.

> The Gallup survey found that John Q. Citizen feels that the most important problem in public schools for 1971 is finances and cutting school costs. By a margin of 49% to 28%, he also favored performance contracting, because it introduces efficiency and accountability--"no results, no pay." By a margin of 54%, he also favored school boards hiring management "experts" to find areas where school costs can be reduced. (Blaschke, 1971a:245)

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* of Education Turnkey System, management support group for OEO's experiment in performance contracting.

Yet the teachers have made their case with the average citizen, for he includes among rejected suggestions for cutting costs both the reduction of the number of teachers by increasing class size and the reduction of teachers' salaries by a fixed percentage (which could be accomplished by hiring paraprofessionals or less experienced teachers)--neither of which would endanger pupil performance.(Blaschke, 1971a)

But inasmuch as the teachers' constituency sets its priorities in favor of better management and cutting costs, teachers are ultimately in a vulnerable position. Insofar as it can be demonstrated that the use of instructional technology is more efficient than costly and unproven certified personnel and this information can be made widely known to the public, John Q. Citizen is likely to strengthen his support for better management.

The National Institute of Education could prove to be a source of such knowledge of cost-efficiency, as well as the more attractive cost-effectiveness foreseen by advocates of the technology. For among the suggested missions of the NIE is research and development designed to increase our ability to use technology and media effectively in education, including: instructional uses of the computer; cassette television; games and simulations; and instructional environment. (Levien, 1971:89)

Moreover, there are other conditions which might facilitate the use of technology. The President's Commission on School Finance (1972) not only endorses the role of the NIE to generate and disseminate knowledge of the potential value of educational technology, but further suggests that "state governments establish state-wide evaluation systems to measure the effectiveness of educational programs" and "that class size standards and pupil/teachers ratios be used sparingly and selectively in the preparation of school budgets and the allocation of staff until and unless further research indicates conclusively otherwise" (Pres. Comm. on School Fin., 1972:58;59).

The recommendation that states assume the major burden of financing local school districts has recently been deemed (legally) unnecessary by the Supreme Court. But the fact remains that local districts are dependent upon state aid for a sizable portion of their income--which they would not readily forfeit. We have already noted the interest of state legislatures in PPBS. Indeed, we have noted the same interest on the part of local districts. To the extent, then, that local districts remain dependent upon state agencies and grants from federal agencies, and these agencies, extend tendencies to require competitive bidding,* perhaps specifying that proposals incorporate programs utilizing the findings of research on cost-effectiveness (something local districts might be inclined to do anyway), the likelihood that we would ultimately see the large-scale use of technology in education would be considerably increased.

# # #

It should be noted that one does need to distinguish between readily available conventional audio-visual materials and large-scale systems of instructional television and computer-assisted instruction. The Human Resources Research Organization (HumRRO) is currently engaged in a study of the factors which might account for the slow rate of diffusion of CAI. Until the results of their study are available, we should note that, in order for systems of CAI (and ITV) to be economically feasible--and indeed cheaper than the conventional system of education, which is dependent upon expensive credentialed teachers--they must be able to provide an

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* The effect of the new program of federal revenue-sharing on this proposition remains to be seen.

array of programs (software) to a large number of users. David Berkman (1972) presents the problem for CAI* essentially as follows:

Few schools now have the hardware for CAI. It is very expensive to develop quality programs of instruction to deliver via computer. It would be extraordinarily expensive to develop curriculum-wide systems of CAI. What learning company is ready to invest such large sums of money "to develop curriculum-wide computer-based instructional systems, when no schools have the hardware through which CAI can be offered? What school is ready to commit the millions in capital equipment dollars required to purchase the computer hardware for which programming does not exist?" (Berkman, 1972:458) Berkman suggests that if schools were in a tight enough money pinch, they would be forced to use the ultimately cost-effective CAI.

A recent cost of education index indicates that despite evidence that schools expenditures have increased considerably since World War II (by over 250% in the last decade), increases for 1971-72 were, for the first time, not sufficient to offset the effects of inflation--"the real gain in school expenditures suffered a setback for the first time in many years" (School Management, 1972:21). Schools are indeed feeling the pinch. But the cost-effectiveness of CAI is contingent upon projections into the future of the decreasing cost of CAI as it becomes more widely utilized, which is a fair risk for individual school districts to take at early stages of development. But technology companies would need assurances of a sizable market before developing the software.

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* He suggests a not too different case can be made for the problem of ITV.

It would seem that in order for school districts to benefit from the potential cost-effectiveness of CAI, they would have to jointly decide to invest in it or some form of centralized decision making would have to take place. Given PPBS projection costs into the future, school districts might well make joint decisions to invest in CAI (perhaps encouraged by state agencies)--not such a far-fetched notion, considering how many school districts independently decide to use the same textbooks. It seems not such a big step to become aware of the fact that they so often end up using the same materials, anyway.

Berkman suggests that school districts might initially invest in computers for the purposes of CMI and that, once the schools had the hardware, CAI software would more likely follow. By whatever route, it is difficult to imagine schools in a money pinch, utilizing PPBS, not ultimately turning to the relatively cost-effective educational technology.

VI. YES, BUT. . .

The possibility of large-scale use of educational technology in the public schools is much favored by the growth of the accountability movement; the concomitant introduction of PPBS into education; the possibility of PPBS demonstrating existing and potential cost-effectiveness of technologies; and the use of incentives, particularly by state and local governments. We should, however, consider the possibility of grave consequences, if these are the major conditions under which the technology is to be utilized, not the least of which is the behaviorist learning theory upon which so much of the technology is based.

Behaviorist learning theory is based on the notion that man <u>is</u> his behavior and that his behavior is totally shaped by the influences in his environment, by the reinforcements it offers. By controlling that environment, by positively reinforcing those behaviors we choose to see continued, we can totally control that behavior. Man has no needs that are not controlled by his environment. His consciousness of a "need" for freedom is generated by negative reinforcement. He does not resist control <u>per se</u>, merely aversive control. If we could improve our analyses of behavior and appropriately apply positive reinforcements, eliminating negative reinforcement, we would eliminate his resistance and this supposed "need" for freedom we have come to value. (Skinner, 1971)

As there is clearly no consensus on behaviorist theory as fact, we might do well to consider other theories on the nature of man. George Herbert Mead's (1934) doctrine of emergence posits mind and consciousness emerging in the process of social interaction. But there are two dimensions of self. The biologic "I" is generic to the organism (even without

consciousness). It is the impulsive, active, creative dimension of self--which offers resistance to the "me" which is the socialized, conventional self, shaped by reinforcement. There is more to man than his behavior. Skinner's man, despite his aversion to negative controls, is essentially a passive, socialized "me" whose behavior is totally controlled. Mead does not ignore reinforcement and controls; they are necessary for the self to emerge. But within the self there is always a tension between the socialized "me" and the authentic "I". The biologic "I" implies the possibility of repression, resulting from the control of the "I" by the "me". Skinner's man might resist negative controls, but he does not resist controls per se. Subjected to the appropriate schedule of reinforcements, without aversive control, he cannot be repressed.

Freud's emphasis on the biological and psychological nature of man brings into relief the question of repression. Man lives his life by the pleasure principle; he seeks pleasure and avoids pain. He experiences pleasure when his human needs are met. Some of his needs are physical, but these cannot be satisfied completely. Their satisfaction is limited by his own body, by the forces of nature, and often by civilization (e.g. class structure). But not all his needs are physical.

> The desire for freedom that makes itself felt in a human community may . . . have its origin in the primitive roots of the personality, still unfettered by civilizing influences, and so become a source of antagonism to culture. (Freud, 1929:780)

Man has a need for freedom, but he also has a need for security. "Civilized man has exchanged some part of his chances of happiness for a measure of security" (Freud, 1929:788). His needs extend far beyond those allotted Skinner's man, shaped by controls, which would not exist if our culture chose to properly reinforce him. Indeed, those very controls take their toll.

> . . .it is impossible to ignore the . . .degree to which the existence of civilization presupposes the non-gratification (suppression, repression, or something else?) of powerful instinctual urgencies. This cultural privation dominates the whole field of social relations between human beings . . . (Freud, 1929:781)

But men do not passively submit to repression. As there is always a tension between Mead's "I" and "me", so there is always tension between Freud's libido and ego (and/or conscience)--between man and civilization. It is in his nature to resist.

> The goal towards which the pleasure-principle impels us--of becoming happy--is not attainable; yet we may not--nay, cannot --give up the effort to come near to realization of it . . . .
>
> It does not seem as if man could be brought by any sort of influence to change his nature into that of ants; he will always, one imagines, defend his claim to individual freedom against the will of the multitude. (Freud, 1929:775;780-1)

It is not a totally fruitless struggle. Freud points out that "we cannot abolish all suffering, yet a great deal of it we can, and can mitigate more" (Freud, 1929:776). And Marcuse's (1955) reinterpretation of Freud makes the distinction between repression and surplus repression. Repression will always be with us because of man's constitutional limitations. But surplus repression is suffered over and above what we can attribute to man's nature. It is imposed upon man by the social structure, by the institutional arrangements in that structure, by the distribution and exercise of power in society. These are subject to change by man. There is hope, for there is always resistance.

For Karl Marx (1956; 1864), as for Mead, mind and consciousness are not given; they emerge within a social context. Social being precedes and determines social consciousness. But Marx also sees man as a natural being with human needs. Over and above the animal needs, he has a need to express and fulfill his active, creative potential. He proves himself

a conscious species-being by creating an objective world, which he does even when freed of immediate needs. And it is only then that he is truly free, acting on human needs. Insofar as social structure stifles man's active nature (Mead's "I"), man is made less human; he is debased when he must produce only to satisfy physical needs.

For Marx, as for Mead and Freud, the psyche and soma are a unity with biologic human needs. But Skinner's pure behaviorist perspective views all psyche and soma determined by controls. What Skinner must ultimately grant, while he insists upon the influence of the environment on man's very nature--through the process of natural selection, is that what may very well have been selected is the need for freedom he so much wants to deny. Without the concept of such needs, one cannot appreciate the tension between the "I" and the "me", between man and social structure. Mead, Freud, and Marx approach this tension in different ways, from different perspectives, but they never lose sight of the active, creative dimension of self--of the need for freedom. Skinner's ideal of shaping behavior allows for the creation of an infinite variety of "me's", but it does not permit an "I" to emerge. It overlooks the question of psychological repression resulting from control.

One cannot ignore vital needs, which are fulfilled or repressed by social behavior. Without the concept of such needs, one cannot say that a social system is repressive. One makes of man a passive creature; he is an active, creative being. And freedom is not merely a value--it is a vital need.

The possibility of repression of a human need for freedom through the large-scale use of a more effective educational technology is related to another important question. If we are to shape behavior by means of controls, and perhaps ultimately have the means at hand to make of man what

what we will--what will we make of him? What behaviors will we choose to enforce? Skinner maintains that a culture teaches that behavior which is necessary for its survival. Likewise, Cogswell's defense of his surveillance and detection system of computer-managed instruction is based on the notion that a culture acts in its own interest. But what is in the interest of our culture? And what does it mean to talk of the survival of a culture? The use of "culture" in the abstract suggests an artificial unity to the people of our society.

When we get down to real people we are faced with the fact that a "culture" does not choose behavioral objectives and a "culture" does not have interests. People make choices and people have interests. To assume that all people in our society have the same interests is to ignore the fact that there are innumerable controversies over what to teach in our schools: Will we or will we not teach religion? Will we or will we not teach about the theory of evolution? sex education? communism? To assume that all the people in our society have the same interests means to decide for them what is in their interest (when indeed they may well protest). And who will make that decision?

Beyond the question of what behavioral objectives are chosen, we must ask who is doing the programming? Skinner suggests that

> There are hopeful signs that the epistemological implications will induce experts to help in composing programs. The expert may be interested for another reason. We can scarcely ask a topflight mathematician to write a primer in second-grade arithmetic if it is to be used by the average teacher in the average classroom. But a carefully controlled machine presentation and the resulting immediacy of contact between programmer and student offer a very different prospect, which may be enough to induce those who know most about the subject to give some thought to the nature of arithmetical behavior and to the various forms in which such behavior should be set up and tested. (Skinner, 1968b:50)

The epistemological implications to which Skinner refers are those relating to the ability to shape behavior through programming. But there are other epistemological implications in the notion of having "experts" program instruction which might ultimately be delivered to large numbers of children as a result of centralized decision making. Shall we have "experts" teach religion? evolution? sex education? communism? How shall we determine who the "experts" are? Will we really agree? To grant "experts" access to the minds of our children ignores the real epistemological question of how we know what we "know"--what is fact, what is truth. This is of particular importance when "knowledge" is being communicated by a thing like a computer and the mystique of the machine can lend credence to "facts" derived from a weak knowledge base.

The dangers of ruling out epistemological questions and the mystique of the machine apply as well to systems like PPBS that employ analysts to feed data into a computer that spits out cost-effectiveness analyses of alternative courses of action. PPBS is a model of a system consisting of a number off interdependent variables which are subject to manipulation to achieve desired goals. Implicit in the definition of that system is the existence of an environment in which that system operates--including all elements outside that system, over which we have <u>no control</u> and accept as <u>given</u>. The environment is treated somewhat as we might treat the law of gravity: no one is responsible for it, we cannot do anything about it, we must submit to it. (See Boguslaw, 1965 and Levit, 1972) At this point, it becomes important to ask who is defining this system and determining what variables are given and beyond anyone's responsibility. It may be in the interest of school personnel to take the low socio-economic status of

their students as a given and beyond responsibility. It may not be in the interest of the students to treat their lot so.

Similar questions arise when measures of cost-effectiveness are derived from numbers somehow attached to these variables. What does it mean to determine that program A produces 60 students at a high level of achievement, program B produces 90 students at a lower achievement level, and program C produces 150 students at an even lower level, all at the same cost? (Carpenter, 1971a) Who determined what alternatives would be evaluated (and what alternatives not considered)? Who is to choose which alternative will be implemented?

There is at least one other issue which cannot be overlooked. When a program of instruction is found to be "better" by means of a cost-effectiveness analysis which very likely takes as a given and holds constant the life-conditions of children, and that program is mandated, we may very likely be inhibiting the innovation of alternative programs which might improve those life-conditions.

The development of new educational technology may or may not prove to be more effective or less costly than other programs of instruction. In any event, it is incumbent upon us to urge that, in the determination of how those programs will be used, every effort is made 1) to assure and encourage every possible avenue of access to decision making--for producers and consumers and anyone else who is interested, and 2) to assure that no program be mandated. Only then can we reap the possible benefits of new technologies without blighting the harvest.

VII. SUMMARY

The convergence of three major factors in our society today constitute a powerful force conducive to the large-scale utilization of technology in education:

1) The very fact of the development of impressive technologies in the DoD, NASA, and AEC, and their interest in finding and encouraging civilian application of their discoveries; the use of systems analysis and PPBS, responsible for those discoveries, as a model for the solution of social problems, including education; the notion of incentives to encourage the use of systems analysis.
2) The current predicament of local school districts, pressured by calls from the public and from state and federal authorities for pedagogical and fiscal accountability--encouraging the receptivity of educators to the idea of utilizing available technology, systems analysis, PPBS, and incentives to provide better education.
3) A behaviorist learning theory which supports, even demands, the systematic use of technology to improve education.

In sum, we have seen educators turning to technology in an attempt to solve fiscal and pedagogical problems--all the while groping toward a refined application of PPBS cost-effectiveness analyses which will ultimately determine, probably favorably, the future fate of technology in education.

Moreover, we have cautioned against pitfalls in applying systems analysis, noted for its success in improving man-machine systems, to educational problems--taking care not to place so much emphasis on the aspects of quantification and machinery that we lose sight of the nature of man. We urge that the careful consideration of ultimate goals not be neglected, that the consequences of method not be overlooked, so that our work not be in vain. To insure against such an eventuality, we must assure that all access to decisionmaking remain ever open.

APPENDIX A

VOUCHERS, FREE SCHOOLS, AND COMMUNITY CONTROL

Some critics, comparing schools to other organizations, such as business enterprises, find the problems of schools rooted in their monopoly character. Mark Hanson's (1971) views, representative of this analysis, may be summarized as follows:

Most organizations must compete for scarce resources (input) and for markets for their products (output). In order to survive, they must adapt their product (goals) and productive processes (means) to changes in the availability of resources and demands for products. Having selected their goals, they engage in a sequence of planning processes such as that defined by the U. S. Bureau of the Budget:

1. defining objectives
2. measuring anticipated output of alternative programs which might be adopted to achieve the stated objectives
3. determining the total system costs of alternative programs on a multi-year basis
4. selecting the most appropriate of the alternatives
5. providing a systematic flow of information on outputs and costs for periodic evaluation of progress (Hanson, 1971:19)

The planning sequence is dependent upon selecting operational goals--goals which admit of a means of testing their relationship to alternative processes designed to meet them.

But, says Hanson, schools usually define their goals in non-operational terms, such as:

1. intellectual discipline
2. citizenship and civic responsibility
3. economic interdependence and vocational opportunity
4. social development and human relationships
5. moral and ethical character
6. self-realization (Hanson, 1971:19)

Such goals are so broadly defined that no measuring tools are available to evaluate the degree to which they are reached or the relative effectiveness of alternative programs. The reason schools manage to survive without selecting goals according to (market) demand or evaluating the degree to which and the processes by which they are met is that the schools maintain an effective monopoly of the education enterprise. They need not compete for resources or markets. Students must attend them and accept whatever program is provided. Funding is dependent upon neither school nor student performance; it is assured through public funding. (Hanson, 1971)

Vouchers

The accountability movement and taxpayer resistance are placing strains on schools that require a change. Some who view the source of trouble in the school monopoly maintain that the best way to foster the necessary changes is by forcing the schools to compete for money and students. A number of proposals have been made to fund education by providing parents with educational cash vouchers redeemable by schools in which the parents choose to enroll their children.

The leading advocate of educational vouchers, Christopher Jencks, promotes his plan in a study funded by the U. S. Office of Economic Opportunity on a variety of voucher proposals. A summary of Jencks' plan includes the following provisions:

--Parents choose between competing schools.
--Schools must be open to all applicants.
--Schools must accept the voucher as full payment for the cost of a child's education. Parents may not add money to the value of a child's voucher.
--Each school must make information available which will enable parents to make wise decisions.
--A new independent agency, the Education Voucher Agency (EVA) enforces these regulations and administers the voucher program.

--The value of the voucher is supplemented for the poor, to enable schools to develop special programs for these children.
--All kinds of schools are included--private and religious schools as well as public schools.
(Mecklenburger, 1972:23; see also, Jencks, 1970)

Plans by OEO to implement a voucher experiment based on Jencks' plan have been hampered by the following objections: that educators relinquish to parents the choice of school programs; that parents could add no money to the voucher; that EVA's might displace school boards; that private and parochial schools would be supported by public monies; that teacher rights and desegregation might be adversely affected. The experiment is underway now at only one cite, Alum Rock School District of San Jose, California. But the Jencks plan has been compromised in that: only public schools are included; only one-third of the school district is participating; the Alum Rock Board of Education maintains control, advised by an Education Voucher Advisory Committee of parents; the choice is not among schools but among programs. This is a one year demonstration, the continuation of which is dependent upon three conditions: that the California legislature pass a bill authorizing the creation of an EVA and the use of public monies for private and parochial schools; that Alum Rock doubles the number of experimental students in 1973; that OEO has the funds to continue the program for the next five to seven years. (Mecklenburger, 1972)

The results of the Alum Rock demonstration and any further voucher experiments remain to be seen, including the possibility that they might foster the kind of systems analysis that Hanson and others find necessary to the solution of school problems. We can look forward to a report from the Rand Corporation which has contracted with OEO to evaluate the experiment.

Free Schools

The "free school" movement is made up of people concerned with the direct effect of the public school monopoly on the lives of children. They perceive a rigid, authoritarian bureaucratic structure which stifles the natural urge to learn and create with its prescribed curricula and methods, stressing discipline and grades and credentials. They perceive a structure which creates an artificial environment, distorting the nature of man and learning and reality--at best, irrelevant to the needs of children; at worst, inhumanly destructive. To save children from the boredom, frustration, feelings of impotence and dependency generated by such a structure, they have established hundreds of their own independent "free schools," variously designed to allow children to grow and develop and pursue their own interests unhampered by prescribed, regulated direction. It is hoped that, freed from the fetters imposed in the public schools, children will develop a sense of their own integrity and of others' and the capacity to relate to each other in the real world--so as to create the conditions needed to live human lives.

Although the movement is hardly unified, philosophically or in practice, the rejection of the strictures of public schools (and often of the entire social structure) in many cases leads to a near total non-structured, non-academic learning experience. Exceptions can be found in some inner-city free schools for the minority poor, such as those advocated by Jonathan Kozol, which do stress the teaching of academic skills deemed necessary for these children to better their condition.

Most free schools have a rather tenuous existence due primarily to their acute lack of funds, teachers working for little or no pay, and the trials and tribulations of putting their ideals into practice. (See: Stretch, 1972; Marin, 1972; Daniels, 1972; Greenway, 1972.)

Community Control

Partly because of the ephemeral nature of free schools, some inner-city residents, agrieved by the experience of their children in public schools, have begun to demand "community control." Levin (1972) presents the case for decentralized community control of public schools, summarized as follows:

Large centralized school districts have been rigid and unresponsive to the needs of the minority poor. They have failed to provide these children with the formal education necessary to improve their life-conditions. Curricula and methods designed for white middle class children have dealt destruction to the growth and self-concept of poor black children, leaving them with feelings of incompetence and impotence. Moreover, proposed solutions, such as integration and compensatory education, are an affront to the dignity of the black man. The notion of integration has not only meant false promises but, indeed, implies that blacks can only learn in the company of whites. Compensatory education has meant little more than bigger and "better" doses of the same debilitating white middle class approaches. The view is that only by overcoming their own sense of impotence and gaining control over their schools can the black community assure that the cultural uniqueness of their children will be appreciated and their needs met. (Levin, 1972)

Efforts to gain community control have been hampered by strong opposition from centralized school administrations and teachers' unions unwilling to relinquish control of education (and their jobs) to disgruntled laymen. To date, the community control movement has had little, if any, success.

# # #

Though the education voucher, free school, and community control movements are certainly parts of the larger accountability movement, they are somewhat on the periphery insofar as they are less directly concerned with systematically relating input to output. And although the argument has been made that vouchers would force schools to do so, these three developments concentrate primarily on the selection of objectives and quality of output. Their focus is on breaking the monopoly of large public school systems in the area of decisionmaking and control over the lives of children. They are based on the notion that insofar as this is done, the quality of the school experience and/or its output will improve. On this periphery, the challenge has gone beyond holding schoolmen responsible for doing a job well to doubting it can be done--within the confines of the current structure of school bureaucracy.

APPENDIX B

TESTING STUDENTS AND DETERMINING ACCOUNTABILITY

While increased interest in individualized instruction has been a response to calls for accountability, the determination of pedagogical accountability ultimately rests on the measures employed to assess output (learning or change in pupil behavior). And although there are a few cries on the periphery that there should be no testing per se, the debate actually comes down to "how to measure," not whether or what to measure: If educators are to be held accountable, then output must be measured. We measure changes in behavior in the areas we have intended to influence. We can then attempt to determine what influences, in fact, effected those changes.

Testing Students

The plethora of literature on testing for accountability focuses on the debate over the relative merits of criterion-referenced tests and norm-referenced tests. The examples of individualized instruction discussed above indicated the importance placed on the establishment of measurable behavioral objectives and the determination of criterion performances for meeting those objectives. But most public schools in this country, including many attempting to individualize instruction, employ norm-referenced tests. Jason Millman (1970), editor of the Journal of Educational Measurement, has presented the case for criterion-referenced tests which essentially makes the following argument:

Norm-referenced tests are designed to distinguish the individual's performance from that of others on the same testing device. They are comparative measures wherein a norm is established for the group being

tested. The students are essentially competing against each other; the individual's score is either average, above average, or below average. Most standardized achievement and IQ tests, as well as teacher-made tests on which students are rated A, B, C, etc., are norm-referenced tests. By definition, norm-referenced tests are designed to assure something of a normal distribution of scores; that is, some students will always fall below average.

By contrast, criterion-referenced tests measure an individual's performance with reference to some established criterion, or performance standard, related to a specified behavioral objective. The student's score does not compare his performance to that of others; rather, it is a measure of the student's own progress toward mastery of any given objective. The use of norm-referenced tests is inappropriate when the primary concern is what an individual student has learned.

> A key task of our schools is to maximize the amount of a subject that each student has "mastered." Indeed, a reason for having individualized instruction is to maximize achievement by appropriate pacing and provision of instructional materials. The rational management of such an individualized instructional system requires knowing whether each student can perform at some criterion level on measures of the component objectives of the system. (Millman, 1970:227)

Norm-referenced tests aside, there are those who are skeptical of the notion of structuring teaching around measurable performance objectives, maintaining that there are higher mental processes, such as insight, creativity, an inquiring mind, which constitute goals that cannot be defined in terms of quantifiable short-range behavior objectives, that we ought not attempt to do so, nor risk the possibility of omitting them for lack of such a measure. This is a valid point to raise. Theoretically, of course, such behavioral objectives need not be quantifiable, although--to be sure--a good part of their advocates do seem to be making that demand. Nonetheless, performance criteria can be specified for these objectives which

need not be quantified. Still, it should be noted that, however much today's schools include insight and creativity among their stated goals, it would be a rare school indeed which determined its own success and passed and failed students on the basis of such variables. This is not for nothing. For the life-chances of today's youth, their chances for success in our society, are largely determined by their ability to compute numbers and to speak and read and write the English language. It is precisely in such basic skill areas that most standardized norm-referenced tests measure achievement and efforts to construct criterion-referenced measures are centered.

Of course, it is possible to specify standardized test scores as criterion performances. Most achievement tests were standardized some years ago; they are not restandardized every year. Hence, although at the time of standardization, some students' scores (by definition) fell below the norm, one could specify that subsequent populations tested on these measures must demonstrate proficiency at the level of that norm to achieve mastery of a given subject matter. It is the use of standardized test scores as criterion performances, notably by schools employing performance contractors,* that has generated the greatest controversy among those concerned with testing for accountability.

Lennon (1971) and Stake (1971) expound most of the arguments against the use of standard scores as criterion performances, based primarily on the fact that they were not intended as such--that criterion-referenced tests and norm-referenced tests are constructed for different purposes and that the exigencies of testing are such that neither test is an appropriate measure of the other's purpose: Criterion-referenced tests are

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* See Chapter IV.

constructed so that each item bears a one-to-one relationship to specified behavioral objectives, measuring competence in the performance of specific tasks. They are intended to measure learning. It is not their function to be predictive of future performance on other specific tasks or those of a more generalized nature--nor are they. By contrast, standardized achievement tests are constructed to measure correlates of learning, not actual learning itself. The items on these tests are not related to specific behavioral objectives; they are intended to get at a much wider range of content, sampling the universe of what has been taught. Standardized achievement tests are not intended to measure what specific task an individual student is now capable of performing. Their value rests in their relatively high predictive validity, indicating probable future performance.

It is on the basis of this difference in purpose and construction that charges of "teaching to the test" have been leveled against some performance contracts (Wardrop, 1971; Lennon, 1971; Stake, 1971). Since criterion-referenced tests are intended as direct measure of learning, it is appropriate to teach precisely those behaviors assessed by each test item. But performance contractors are generally evaluated (and paid) on the basis of student performance on standardized achievement tests. Under those circumstances, to teach those precise behaviors which will be assessed by specific test items that are intended as samples of a universe of behaviors--without reference to that universe--invalidates the test; the meaning of the scores is distorted; scores no longer have their intended predictive validity.

Those who would teach to samples of behavior as though they were merely behavioral objectives are further discredited by the fact that when achievement tests are standardized, raw scores (usually the number of items right) are translated into grade equivalents, indicating the average grade

placement of all students with a given raw score. Most performance contractors are paid on the basis of their ability to raise students' grade equivalents, usually by one year. But "the average annual 'growth' on most standardized tests is only a few raw-score points" (Stake, 1971:586; see also, Lennon, 1971 and Wardrop, 1971).

Another major objection to the use of standardized tests to measure learning relates to the aforementioned fact that these tests are designed to predict long-range performance. But again most performance contractors are paid on the basis of short-range gains in the scores of individual students. A rise in grade equivalent is translated into a gain score--which is highly unreliable as a measure of individual improvement.

> The error of measurement of a gain score may very easily equal or exceed the amount of gain normally to be achieved in a short-term intervention. . .
>
> It is almost instinctive to react to this state of affairs by saying "Well, let compensation be based on average gain for a group and avoid the messy question of unreliability of individual gain scores." ... Clearly the intent of the performance contract is to foster the academic growth of every participating learner; and no evaluation plan will be acceptable that allows failure by a significant fraction of the group to make good gains to be offset, in calculating payment, by better-than-average gains by others. (Lennon, 1971:10)

Lennon and Stake discuss a number of ways in which errors in individual gain scores might be reduced, Lennon preferring to lengthen the period over which changes in behavior is assessed, Stake being more optimistic about the possibility of measuring short-term changes--but he cautions: "Corrections for the unreliability of gain scores are possible, but they are not likely to be considered if the educators and contractors are statistically naive" Stake, 1971:587).

Lennon, Stake and others (e. g. Saretsky, 1972) go on to raise additional questions with respect to the use of standardized achievement tests to measure learning. Suffice it to say that any school which would

do so must come to terms with these issues--for, of course, they apply to such use by any school. The arguments are currently directed at their use by performance contractors because of the high visibility of contractors in their bold attempt to make schools accountable by providing guarantees and because they are paid on the basis of gain scores.

Indeed, as one examines the literature encompassing the testing controversy, one cannot help sensing that much of the furor centers on determining the accountability of educators for the performances they effect--and rewarding them accordingly. For the arguments of critics notwithstanding, schools have been using standardized achievement for many years to measure the learning of students (given credence by the tests' predictive validity). It is on the basis of such tests that "low-achievers" and "slow-learners" are so labeled.* And it is on the basis of these labels that the dismal life-chances of many of these children are determined. The notion of judging the efficacy of schoolmen--and paying them--on the basis of these same tests has generated the closest scrutiny of the tests--and performance contractors. This is perhaps most clearly illustrated by the controversy over the use of extrinsic rewards by performance contractors.

Amid loud protest against the deleterious effects of extrinsic rewards, Tuinman et al. (1972) demonstrated that contractors might appreciably raise scores on achievement tests merely by increasing motivation with the promise of rewards made just prior to testing. Hence, contractors might collect sizable sums of money without teaching, i.e. without effecting learning. Aside from the fact that that is precisely what many teachers have been doing without so much as raising achievement test scores (part of the reason for the accountability movement), Tuinman et al.,'s findings

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* and their high-achieving peers promoted and rewarded.

might better be interpreted as evidence of insufficient motivation for many students to perform without extrinsic rewards. Apparently, the "standard levels of motivation"* available to students not promised rewards are inadequate to get students to tell us what they know. It seems a bit peculiar that when we can improve student performance--merely by increasing motivation--those same tests that labeled those same students "low-achievers" are not called into question, especially given the grave consequences for these students and the focus of the accountability movement on improving their performance (Anderson and Lipman, 1972a and 1972b; see also, Saretsky, 1972.) Ironically, while the doctor is re-examining his instruments in preparation for a new treatment, he would suspend the old, and the patient gets caught in the middle. For until he gets those instruments calibrated, he would impose a double standard. The tests are good enough to get you into the "dumb class" but not good enough to get you out.

This is not to discount the validity of the many questions raised in the context of efforts to make schools accountable and to develop appropriate measurement techniques. It is to recognize that the task is no simple one, that efforts to work it out are in an embryonic stage, and that it may take some time.** Hopefully, in the interim, no double standard need apply; and hopefully, in the process, the need for sufficiently motivating students will not be overlooked.

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* as described by Tuinman et. al. (1972:216)

** In the context of the continuing debate over the pros and cons of criterion vs. norm-referenced tests, we might note that while Millman maintains that criterion-referenced tests can be readily constructed (and we have noted above programs of individualized instruction preparing their own), Lennon and Stake remain skeptical of the reliability and validity of these tests, indicating that the construction of quality criterion-referenced tests is no small task.

Determining Accountability

While the techniques of measuring learning are being refined, efforts proceed to develop methods of assessing school accountability. In order to deal with the problem of how to set criterion performances for schools, these accountability measures are relative, involving comparisons among schools and/or groups of students. Also, since relatively few schools as yet attempt to specify criterion performances differentially for students and since efforts to assess school accountability might be rather more complex in these cases,* initial proposals assume a uniform set of criterion performances for all students.

The Yardstick Project is a rather modest effort currently being tested in twenty-four Ohio school districts. As suggested above, at this early stage of the accountability movement, many of the questions concerning the measurement of learning are raised in the context of using these measures to determine the output of educators--for which they are held accountable and on the basis of which they are appropriately compensated. Hence, Lennon's objection to the notion of performance contractors' being paid on the basis of average gain which might detract from the concern for individual growth. Since the Yardstick Project is less immediately concerned with the matter of providing incentives for educators** and is intended first as a tool for school district administrators to compare the output of schools,*** it does rely on

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* claims of fiscal and pedagogical accountability by such programs of individualized instruction, notwithstanding

** though teacher pay does fall within the realm of its concerns

*** though it could be logically adapted for use within individual schools and classrooms, and need not preclude concern for individual student growth

average gain scores. In fact, the Yardstick Project might best be viewed as a representation of what one might expect from first efforts to institute "accountability" in the midst of debate over its meaning and methods without actually taking into account many of the issues being raised. Nonetheless, it is as least a first effort.

The first task the Yardstick Project set for itself was to find a means of evaluating the comparative performance of schools within a local district which would not be distorted by the differences in student bodies, so often mentioned as factors precluding comparison among schools.

> The hypothesis: Differences in the achievement growth of a group of pupils in one school, compared to the growth of a similar group of pupils in another school, depends less on the backgrounds of the pupils than on the programs offered in the schools themselves.
> (School Management, 1970:20)

Standardized achievement tests were chosen as "universal yardsticks"--first, because scores on them are available in the records of most schools; and second, because they embody norms for each grade level. Hence, average gain scores could be used to determine each school's "yearly value added to pupils' scores." To make certain that "value added" scores were comparable, Yardstick researchers utilized a computer to isolate "conditions" of learning which might differentiate among groups of students. From among hundreds of variables, they found the students' IQ's and their fathers' occupations to be the best indicators of such differences.

> Working within these indicators, they verified that achievement levels are closely related to intelligence and background. But they also found that achievement growth is not significantly dependent on those factors. It is more dependent on the students' experiences in school. (School Management, 1970:20)

Now the Yardstick Project could develop its "growth gauge," a series of charts for the district as a whole and for each school. The former indicate grade-by-grade changes in achievement as students move through the system, as well as yearly changes in student body make-up, in terms of IQ and socio-economic background. The latter indicate each school's yearly value added to students' scores by IQ and fathers' occupation. (School Management, 1970:20-21)

Having developed the growth gauge to pinpoint which schools contribute how much yearly value added to which students--"an instrument for measuring the output of past and present school district policies and programs," the Yardstick researchers set about their second task: a planning model to evaluate the implications of proposed changes in policies and programs. The planning model utilizes the computer to process "data available in most school files" for cost-benefit analysis.

> The model will project the consequences of juggling class sizes, raising the teacher pay scale, building a new school, or performing a host of other alternatives. The advantage, of course, is that the effects of alternate plans can be analyzed without actually trying them, without committing the district and without spending a great deal of time or money. (School Management, 1970:21)

While the Yardstick Project may not deal with all the complexities of the issues raised in the context of the accountability movement, it is putting "accountability" into practice, insofar as it is instituting the utilization of measures of school output and tools to aid pedagogical and fiscal accountability.

A rather more sophisticated approach to pedagogical accountability has been developed for New York City schools by the Educational Testing Service in collaboration with a committee comprised of representatives of the city's main educational power groups. While the plan has yet to

be publicly released, a preliminary proposal set forth by Henry Dyer (1970), of ETS, outlines a plan with several unique features. Like the Yardstick Project it assumes the joint accountability of the school staff. But Dyer emphasizes that accountability is a two-way street: the professional staff is to be held accountable

> for knowing as much as it can (a) about the intellectual and personal-social development of the pupils in its charge and (b) about the conditions and educational services that may be facilitating or impeding the pupils' development. . . . for using this knowledge as best it can to maximize the development of its pupils toward certain clearly defined and agreed-upon pupil performance objectives.
>
> [But the] board of education has a corresponding responsibility to provide the means and technical assistance whereby the staff of each school can acquire, interpret, and use the information necessary for carrying out the two foregoing functions.
> (Dyer, 1970:206)

Most of the literature on accountability concentrates on the need for relating input to output--that is, relating material and human resources expended to the quality of pupil performance that accrues. But Dyer explicitly recognizes four distinct groups of variables in his pupil-change model, stressing that any measure of accountability is meaningless unless all four are taken into consideration.

> The input to any school at any given level consists of the characteristics of the pupils as they enter that level of their schooling: their health and physical condition, their skills in the three R's, their feelings about themselves and others, their aspirations, and so on. The output of any school consists of the same characteristics of the pupils as they emerge from that particular phase of their schooling some years later.
> (Dyer, 1970:207)

The characteristics herein considered are those for which the schools are to be held accountable, those for which its activities are designed to effect a change. Dyer's redefinition of input stresses the fact that pupil characteristics are not the same as they enter the school and that they are a fixed condition over which the schools have no prior

control. But they are not comparable to the Yardstick Project's use of IQ as a "conditioner of learning." To the contrary, it is unlikely that IQ would be among the pupil characteristics considered, as few schools would include it among the characteristics they intend to change. (Dyer also stresses that these characteristics would not be limited to academic areas.) That output measures would be applied "some years later" indicates that Dyer adheres to the notion (discussed above) that accountability is not possible for short periods of time. But these output measures are not themselves measures of accountability. To Dyer they are meaningless without taking into account a third group of variables--the surrounding conditions within which a school operates and which might influence teaching and learning. This group of variables encompasses home conditions, including the physical condition of the home, parents levels of income and education, family pressures; community conditions, including ethnic character, population density, available social agencies, degree of industrialization, etc.; and school conditions, including school plant, pupil-teacher ratio, esprit de corps of the staff, etc. Dyer points out the need to distinguish those surrounding conditions which would be hard for the school staff to change from those which would be easy to change, suggesting that the staff would not be able to influence parents' socio-economic position but might well be able to influence their attitudes toward the school by involving them in its operation, that the school plant might be difficult to change but the staff's esprit de corps might not.

> The identification of hard-to-change as contrasted with easy-to-change surrounding conditions is of the utmost importance in in working toward objective criteria of professional accountability, since the staff of the school can hardly be held accountable for changing those factors in its situation over which it has little or no control. (Dyer, 1970:207)

The measure of professional accountability or school effectiveness would be derived from measures of input, output, and hard-to-change

surrounding conditions through a series of regression analyses. It would indicate where corrective action needs to be taken. What that action might be would be determined by close scrutiny of the easy-to-change surrounding conditions and the fourth set of variables--those making up the educational process, encompassing all activities in which the school engages to effect changes in pupil characteristics. Of the latter Dyer ask three questions: "1) Are they adapted to the individual needs of the children in the school? 2) Do they work, that is, do they tend to change pupils in desirable ways? 3) What, if any, negative side effects may they be having on the growth of the children?" For Dyer, it is crucial that all four sets of variables be taken into account.

> If a school staff is to maximize pupil output in any particular way, it must be aware of the nature of the interactions among the variables in the system and be given sufficient information to cope with them in its work. This in turn means that, insofar as possible, all variables in the system must be measured and appropriately interrelated and combined to produce readily interpretable indices by which the staff can know how much its own efforts are producing hoped-for changes in pupils, after making due allowances for those variables over which it has little or no control. I call such indices school effectiveness indices (SEI's). (Dyer',1970:207-8)

Each SEI indicates the degree to which a school has been effective in furthering one area of pupil development over several years. It also differentiates among students with high, medium, and low levels of output for that area of development within that school, so that the school can determine whether it is differentially serving the three groups in each area. Which areas of pupil development might be included in a profile of SEI's, Dyer stresses, must be determined by all interested groups: pupils, parents, teachers, administrators, board members. While different schools may not have the same objectives, measures of input and hard-to-change surrounding conditions must be applied to all schools in a district in order to derive appropriate SEI's for any given school. The procedure

would work as follows to assess effectiveness in teaching reading in the middle grades of an elementary school: Measures of input in reading at the beginning of fourth grade and averages of hard-to-change condition variables are summarized "in terms of the grade six predicted average reading levels as determined by the regression analysis." Output measures of actual reading levels are taken at the end of grade six.

> For each school, the discrepancy between its predicted grade six reading level and its actual grade six average reading level is used as the measure of the effectiveness with which it has been teaching reading over the three year period. It is the discrepancy between predicted and actual level of performance that is used to determine the SEI in reading for any school. . . .
> . . . . . .
> . . .it should be noted that the proposed method of computing school effectiveness indices automatically adjusts for the differing circumstances in which schools must operate.*
> (Dyer, 1970:209)

Easy to change conditions and educational process variables of schools with comparable predicted levels but different actual levels would be systematically analyzed to determine possible corrective action for deficient schools.

Dyer's plan is presented here at length, because it is one of the few proposals that takes into account many of the complexities of assessing school accountability. While Dyer grants that measures of many of the variables are not readily available,** he notes that many are; and he urges that first steps be taken toward eventual full-scale implementation. Apparently New York City is about to take those steps--with a 1975 target date suggested for field tests to begin, the interim to be spent on the setting of objectives and the development and improvement of measures.

(Bard, 1972)

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* We might note, as well, that in Dyer's choice of method, he has explicitly rejected the conventional use of grade equivalencies.

** All variables would have to be quantified.

Project Yardstick and Dyer's proposal are both based on the notion of collective accountability of a school's staff, finding out which schools are deficient in providing education and taking corrective action. Ultimately, however, for many people accountability means that the individual is responsible for doing his job competently. Dyer rejects out of hand the possibility of separating the influence of any given teacher from other school variables. And the notion of holding any individual responsible for a job not-so-well done, while attractive to parents and taxpayers, tends to make educators nervous.*

Rand analyst Stephen Barro (1970) has dealt with this problem at length and has proposed a technique not unlike Dyer's. Like Dyer, his first concern is that no one be held responsible for the influence of variables over which he has no control, and Barro finds a multiple regression analysis the tool for the task. He merely takes Dyer's approach one step further. "The basic technique is multiple regression analysis of the relationship between pupil performance and an array of pupil, teacher, and school characteristics. However, the proposed methodology calls for two or three separate stages of analysis." (Barro, 1970:201)

Summarizing Barro's elaborate plan, we can say briefly, that, having obtained measures of pupil performance, the first stage of the analysis would entail separating the effects of schooling from those that can be attributed to pupil characteristics. Barro includes among the latter those variables Dyer terms "surrounding conditions." Given a measure of the extent to which schooling influenced output, the second stage would distinguish the contribution of the individual from the effects of school and classroom variables beyond the control of the teacher--including, in addition to those suggested by Dyer, characteristics of

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* See above discussion of testing and Chapter V.

of the school's teaching staff and administrative and support personnel. A third stage might even distinghish among teacher characteristics* which had a greater or lesser effect on pupil performance. Barro suggests that a similar approach could be used to determine the accountability of school administrators, although he notes that difficulties might arise where two or more persons shared responsibilities for the same task. This would apply as well to attempts to determine accountability of administrators of the district. Of course, if responsibilities could be distinguished or if they were merely jointly determined, the "output" being measured at this level is the quality of policy making and management.

The data generated from the use of an accountability measure such as this could have valuable policy implications. Beyond the identification of relatively more or less effective schools and the indication of measure which might be taken to improve resource allocation--including evaluation of the relative effectiveness of educational technologies, data on the effects of distinct personnel characteristics could be used to refine personnel policies. Barro points out that such data could be used to guide personnel selection and assignment and might be applied to the development of a system of incentives--merit pay.

Barro is aware of potential problems with this accountability measure: 1) omission of variables; 2) possible intercorrelation of variables, e.g. "better" teachers tend to end up teaching students of higher socio-economic status; 3) structural limitations of the model, e.g. relationships among pupil performance variables not accounted for by considering output in each area of growth separately.** And, of course,

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* "age, training, experience, ability and personality measures if available, ethnic and socio-economic background, etc." (Barro, 1970:202)

** He indicated that there are measures which might be taken to mitigate the effect of the last two problems. The first will, no doubt, always be a possibility.

the model would need to be tested for validity. But he maintains that the benefits that might accrue from the use of such a system warrant the effort involved in its development.

It is fair to say that the entire area of testing and measurement--determining what a student has learned and what factors account for that learning--is in somewhat of an embryonic stage, that the controversy generated by the accountability movement has stimulated interest in it and will likely contribute to its development.

REFERENCES

Alkin, Marvin C. "Accountability Defined." Evaluation Comment, III (May, 1972), 1-5.

_____, and Bruno, James E. "System Approaches to Educational Planning." Social and Technological Change: Implications for Education. Edited by Philip K. Piele and Terry L. Eidell, with Stuart C. Smith. Eugene, Oregon: University of Oregon Press, 1970.

An Experiment in Performance Contracting: Summary of Preliminary Results. OEO Pamphlet 3400-5, Office of Economic Opportunity. Office of Planning, Research, and Evaluation. Washington, D. C.: February 1, 1972.

Anderson, Barry D., and Lipman, Dale. "Bert: Another Look at Performance Contracting." Unpublished paper. Graduate Institute of Education. Washington University, 1972.

_____. "Material Rewards and Test Performance: The Case of Bert." Unpublished paper. Graduate Institute of Education. Washington University, 1972.

Atwater, Verne S. "Industrial Approaches to Urban Education." Industrial Approaches to Urban Problems. Edited by Jordan D. Lewis and Lynn Lewis. Praeger Special Studies in U. S. Economic and Social Development. New York: Frederick A. Praeger, Inc., 1972.

Bard, Bernard. "New York Accountability Plan Starts to Take Off." Nation's Schools, XC (September, 1972), 22-23.

Barro, Stephen M. "An Approach to Developing Accountability Measures for the Public Schools." Phi Delta Kappan, LII (December, 1970), 196-205.

Berkman, Dave. "The Myth of Educational Technology." The Educational Forum, XXXVI (May, 1972) 451-460.

Blaschke, Charles. Performance Contracting Costs, Management Reform, and John Q. Citizen." Phi Delta Kappan, LIII (December, 1971), 245-247.

_____. Performance Incentive Remedial Education Experiment. Final Report to the Office of Economic Opportunity. Washington, D. C.: Education Turnkey Systems, August 31, 1971.

Boguslaw, Robert. "The Design Perspective in Sociology." The Sociology of the Future. Edited by Wendell Bell and James A. Mau. New York: Russell Sage Foundation, 1971.

_____. The New Utopians: A Study of System Design and Social Change. Englewood Cliffs, N. Y.: Prentice-Hall, Inc., 1965.

_____. Review of Beyond Freedom and Dignity, by B. F. Skinner. Contemporary Sociology, I (January, 1972), 23-29.

_____. "System Concepts in Social Change." Paper presented at California Institute of Technology. Lecture series: Systems Concepts for the Private and Public Sector, June 1, 1971.

Bretz, Rudy. The Selection of Appropriate Communication Media for Instruction: A Guide for Designers of Air Force Technical Training Programs. A Report prepared for United States Air Force Project Rand. R-601-PR. Santa Monica, California: The Rand Corporation, February, 1971.

Burt, Samuel M., and Lessinger, Leon M. Volunteer Industry Involvement in Public Education. Lexington, Mass.: D. C. Heath & Co., 1970.

Callahan, Raymond E. Education and the Cult of Efficiency. Chicago: University of Chicago Press, 1962.

Campbell, Robert E. "Accountability and Stone Soup." Phi Delta Kappan, LIII (November, 1971), 176-178.

Carpenter, Polly. Analysis of Educational Programs. P-4576. Santa Monica, Calif.: The Rand Corporation, March, 1971.

_____. Cost-Effectiveness As an Aid to Making Decisions in Education. P-4517. Santa Monica, Calif.: The Rand Corporation, December, 1970.

_____. A New Kit of Tools for Designing Instructional Systems. P-4611. Santa Monica, Calif.: The Rand Corporation, April, 1971.

_____., and Hall, George P. Case Studies in Educational Performance Contracting. Vol. I: Conclusions and Implications. R-900/1 HEW. Prepared for the Department of Health, Education, and Welfare. Santa Monica, Calif.: The Rand Corporation, December, 1971.

Cogswell, John F. "Instructional Management Information Systems." Man-Machine Systems in Education. Edited by John W. Loughary. New York: Harper & Row, 1966.

_____. "Systems Technology in Education: Man-Machine Systems in Education. Edited by John W. Loughary. New York: Harper & Row, 1966.

Daniels, Lee. Review of Free Schools, by Jonathan Kozol. New Schools Exchange Newsletter, No. 76 (April 15, 1972), 2-3.